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CONTENTS.

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A REPORT on Twenty five Cases of Tetanus (to the Medical Research Committee) By H. R. DEAN, M.D.Oxon., F.R.C.P. Lond., Major, Royal Army Medical Corps (T.). (From the 2nd Western General Hospital and the Department of Pathology of the University of Manchester.) 673

ORIGINAL ARTICLES.

The Intramuscular *versus* the Intrathecal Route in the Treatment of Tetanus by the Injection of Antitoxin. By Sir DAVID BRUCE, C.B., M.B., C.M.Edin., F.R.C.P. Lond., F.R.S., Surgeon-General, Army Medical Service; Chairman, War Office Committee for the Study of Tetanus 680

On the Intrathecal Route for the Administration of Tetanus Antitoxin. By F. W. ANDREWES, M.D. Oxon., F.R.C.P.Lond., F.R.S., Major, Royal Army Medical Corps (T.); Member of the War Office Committee for the Study of Tetanus. With a Note on a Case of Tetanus Successfully Treated. By F. W. ANDREWES and THOMAS J. HORDER, M.D., F.R.C.P Lond. 682

A Comparison of Subcutaneous with Intravenous and Intrathecal Administration of Tetanus Antitoxin in Experimental Tetanus. By F. GOLLA, M.B., B.Ch. Oxon., Captain, Royal Army Medical Corps (T.F.); Member of the War Office Committee for the Study of Tetanus. (From the Physiological Laboratory of the University of London) 686

A Statistical Note on an Analysis of Cases of Tetanus in the British Expeditionary Force. By M GREENWOOD, Jr., M.R.C.S.Eng., L.R.C.P. Lond., Captain, Royal Army Medical Corps (T.F.); Reader in Medical Statistics, University of London. (From the Lister Institute of Preventive Medicine.) 687

Note on a Bacillus Resembling *B. Tetani*. By R. S. ADAMSON, M.A.Cantab., B.S Edin., and D. W. CUTLER, M.A.Cantab., B.Sc. Lond. From the Department of Pathology, University of Manchester. (Report to the Medical Research Committee.) 688

A Case of Tetanus Treated by Intrathecal and Intramuscular Injection of Antitoxin. By JOHN GOW, M.B. Manch., F.R.C.S.Eng., Assistant Resident Surgical Officer, Manchester Royal Infirmary 689

REVIEWS AND NOTICES OF BOOKS.

Makers of the XIXth Century: Herbert Spencer. By Hugh Elliot 689

Il Nuovo Metodo Italiano per la Cura Antirabbica. By Professor Claudio Fermi 690

An Index of Differential Diagnosis of Main Symptoms. By Various Writers. Edited by Herbert French, M.A., M.D. Oxon., F.R.C.P. Lond. Second edition 690

LEADING ARTICLES.

TOXIN AND ANTITOXIN: TETANUS PROBLEMS 691

THE HEALTH OF MUNITION WORKERS 692

ANNOTATIONS.

The Physical Welfare of Mothers and Children 693

The Incidence of Insanity during the War 693

Clean Milk 694

Fragilitas Ossium, Blue Sclerotics, and Otosclerosis ... 694

Placental Transmission 695

A Public Health Laboratory for North Wales 695

School Reform in the Future ... 696

Acute Pulmonary Abscess Treated by Artificial Pneumothorax 696

URBAN VITAL STATISTICS:

English and Welsh Towns 698

Scotch Towns 698

Irish Towns 698

Vital Statistics of London during March, 1917 698

Analysis of Sickness and Mortality Statistics in London during March, 1917 699

SPECIAL ARTICLES.

Medicine and the Law: R. v. Caley: Successful Appeal.—The Liability of a Husband for Medical Attendance on His Wife 697

The Radium Institute, London 698

The Services: Indian Medical Service.—Royal Naval Medical Service.—Royal Army Medical Corps 704

CORRESPONDENCE.

Tuberculosis and the War (Dr. Frank Clifford, Dr. Edward E. Prest) 700

The Technique of Lumbar Puncture (Mr. Sheffield Neave) 700

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Modified Tetanus (Captain R. J. McNeill Love, R.A.M.C.) 701

Optical Aids 701

THE WAR.

The Casualty List 702

Deaths among the Sons of Medical Men 702

The Honours List 702

The United States and the War 702

The Post Office and the War 703

Auxiliary Royal Army Medical Corps Funds 703

Administrative Reform in Mesopotamia 703

A Dublin Hospital for France 704

Quinine, Phenacetin, and Formaldehyde 704

British Universities and the War 704

Windlesham Military Hospital 704

Medical Men in Ireland and Military Service 704

MEDICAL NEWS.

Literary Intelligence 690

Royal College of Surgeons of England 690

Royal College of Physicians of London 690

Central Midwives Board 690

The Hanbury Medal 705

Norfolk and Norwich Hospital 705

Royal Colleges of Physicians and Surgeons of Edinburgh and Royal Faculty of Physicians and Surgeons of Glasgow: Pass list 705

Royal Medical Benevolent Fund 705

West London Medico-Chirurgical Society 705

London Mission Hospital, Siaochang, China 706

Edinburgh University 706

Winsley Sanatorium, near Bath 706

The late Mr. Walter Gibson 706

PARLIAMENTARY INTELLIGENCE.

Notes on Current Topics: The Budget.—Criminal Law Amendment Bill.—Venereal Disease Bill 706

House of Commons: Medical Reclassification in the Army.—Men Discharged for Tuberculosis.—Medical Examinations in Prisons.—Ministry of Health.—Training Disabled Soldiers.—Payments to Panel Practitioners.—Inoculation Department of St. Mary's Hospital.—Treatment of Blinded Soldiers in Scotland.—Calling up the Medical Profession 706

Appointments 707

Vacancies 707

Births, Marriages, and Deaths .. 707

Notes, Short Comments, and Answers to Correspondents ... 708

Medical Diary 709

Editorial Notices 709

Manager's Notices 709

Meteorological Readings 709

Books, &c., received 710

Acknowledgment of Communications received 710

FOR INDEX TO ADVERTISEMENTS SEE PAGE 2.

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INDEX

MEDICAL AND OTHER BOOKS AND PUBLICATIONS

PAGE

ARNOLD:—
Collie, Sir John—Malingering 4
Howard—The Practice of Surgery 4
Horst—Medical Diseases of the War 4
Midwifery 4
Stewart—Diagnosis of Nervous Diseases 4

BAILLIERE, TINDALL & COX:—
Doyen's Surgical Therapeutics and Operative Technique 5
Gardner—Manual of Surgical Anæsthesia .... Cover 1
Hayes—Intensive Treatment of Syphilis and Locomotor Ataxia by Aachen Methods .... Cover 1

BALE, SONS & DANIELSSON:—
Goodwin—Field Service Notes for R.A.M.C. 1

CASSELL & CO.:—
Jones—Military Orthopædics 8

CHURCHILL, J. & A.:—
Hare—Alcoholism .... Cover 1
Rowlands and Turner—Operations of Surgery .... Cover 1
Squire's Companion to the British Pharmacopœia .... Cover 1

CONSTABLE & CO.:—
Battle—The Acute Abdomen 8
Battle and Corner—Surgery of Diseases of the Appendix Vermiformis 8

PAGE

DANIEL:—
Rabagliati—Initis or Nutrition and Exercises 6

FROWDE AND HODDER & STOUGHTON:—
Mackenzie, Sir J.—Diagnosis and Treatment in Heart Affections 6
Mackenzie, Sir J.—Diseases of the Heart 6
Mackenzie, Sir J.—Heart Affections .... Cover 1

GRIFFIN & CO.:—
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KIMPTON:—
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Allen—Vaccine Therapy 7
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Curgenven—The Child's Diet 7
Davidson—Localization by X Rays and Stereoscopy 7
Dawson—Causation of Sex in Man 28
Elliot—Glaucoma 28
Emery—Clinical Bacteriology and Hæmatology .... Cover 1
Gordon—Diseases of the Nervous System 7
Ham—Handbook of Sanitary Law 7

PAGE

LEWIS & CO.—(Continued).
Harris—Lectures on Medical Electricity to Nurses 7
Hellman—Amnesia and Analgesia in Parturition 7
Kettle—Pathology of Tumours .. 28
Lewers—The Diseases of Women 28
Magill—Notes on Galvanism and Faradism 28
Martindale and Westcott—The Extra Pharmacopœia 7
Moullin—Enlargement of Prostate .... Cover 1
Moullin—The Biology of Tumours Cover 1
Osler, Sir William—Aequanimitas 28
Phillips—Amœbiasis and the Dysenteries 28
Powell, Sir R. D., & Hartley—On Diseases of Lungs and Pleura Cover 1
Scott—Modern Medicine and Some Modern Remedies 28
Scott—The Road to a Healthy Old Age 28
Shuttleworth and Potts—Mentally Defective Children 28
Swanzy's Handbook of Diseases of the Eye and their Treatment .. 7

LONGMANS, GREEN & CO.:—
Toxic Jaundice in Munition Workers .... Cover 1

MACMILLAN & CO.:—
New System of Gynæcology 8

PAGE

MEDICAL PUBLISHING CO.:—
Lane, Sir A.—Operative Treatment of Fractures .... Cover 1

MURRAY:—
Dolbey—A Regimental Surgeon in War and Prison 6
Leftwich—Index of Symptoms 6
Wilson—Early Diagnosis of Heart Failure 6

SAUNDERS COMPANY:—
Albee—Bone-Graft Surgery 3
Cabot—Differential Diagnosis 3
Morrow—Diagnostic and Therapeutic Technic 3
Norris—Gonorrhœa in Women .. 3
Saunders' Books for Physicians and Surgeons .... Cover 1
Scudder—Tumours of the Jaw 3
Smithies and Ochsner—Cancer of Stomach 3

WRIGHT & SONS (BRISTOL):—
An Index of Prognosis and End-Results of Treatment .. Cover 1

MEDICAL LIBRARIES, &c.:—
Baker—Books 8
Behnke—Stammering, &c. 8
Ketley—Stammering 8
Lewis & Co.'s Medical and Scientific Circulating Library. Cover 1
Matthews—Wood: Application of Trusses to Hernia 8

OFFICIAL AND GENERAL ANNOUNCEMENTS

ASSISTANCIES, MEDICAL 51

ASYLUMS, HOMES, &c.:—
Ashwood House, Kingswinford .. 45
Barnwood House Hospital 46
Bishopstone House, Bedford 45
Brunton House, Lancaster 45
Camberwell House, Peckham-road 47
Clarence Lodge, Clapham Park .. 45
Colthurst House School, Alderley Edge 46
Coppice, The, Nottingham 46
Court Hall, Kenton, near Exeter. 46
Dalrymple House, Rickmansworth 47
Dartmoor Sanatorium 46
David Lewis Colony, Alderley Edge 46
Duff House, Banff 48
General Manager, Craven-street.. 45
Ghyllwoods Sanatorium 47
Grove House, Church Stretton .. 46
Grove, The, Catton, Norwich 46
Haslemere Nursing Home 49
Havelock Lodge, Newton-le-Willows 47
Hoigham Hall, Norwich 46
Homes for Inebriate Women 47
Littleton Hall, Brentwood 49
London Fever Hospital 48
Mailing Place, Kent 48
Melbourne House, Leicester 47
Mendip Hills Sanatorium 48
Moat House, Tamworth 46
Newmains Retreat, Lanarkshire.. 48
Nordrach-on-Dee, Banchory 48

ASYLUMS—(Continued).
Northumberland House, Finsbury Park 45
Northwoods House, Winterbourne 47
Peckham House 47
Pendyffryn Hall Sanatorium, Nordrach-in-Wales 48
Plympton House, Plympton 48
Portsmouth Corporation Mental Hospital 45
St. Andrew's Hospital, Northampton 46
Shaftesbury House, Formby-by-the-Sea 47
Springfield House Private Asylum, Bedford 45
Stretton House, Church Stretton. 48
The Grange, near Rotherham 48
Vale of Clwyd Sanatorium 49
Warneford Asylum, Oxford 45
Westholme, Torquay 49
Wye House, Buxton 48

FINANCIAL, &c.:—
Equitable Reversionary Interest Society 44

HEALTH RESORTS, BATHS, &c.:—
Caterham Sanitarium 49
Droitwich Brine Baths 49
Smedley's, Matlock 49

HOSPITAL, INFIRMARY, SANATORIUM, &c., VACANCIES .. 49 51

HOUSE & ESTATE AGENTS:—
Heath, Brook, & Sneath, Arundel-street, Strand 52

LIFE & FIRE ASSURANCES, &c.:—
Medical Sickness and Accident Society 37
Prudential 45

MASSAGE:—
Associated Male Nurses and Masseurs 44

MEDICAL ACCOUNTANTS, &c.:—
Turner 52

MEDICAL AGENTS 55

MEDICAL SCHOOLS—(LONDON.)
Guy's Hospital Medical School .. 42
London School of Clinical Med. .. 42
University of London, King's College 42
West London Post-Graduate Coll. 42

NURSES' ASSOCIATIONS:—
Co-operation of Temperance Male and Female Nurses 44
Female Nurses Association 44
General Nursing Association 45
Hospital for Sick Children 44
London Nurses' Association 44
London Temperance Nurses Co-operation 45
Mental Nurses Association 44

NURSES' ASSOC. (Continued).
Mental Nurses' Co-operation 44
New Mental Nurses' Co-operation 44
Nurses' Association 45
Nurses' Co-operation 45
Registered Nurses' Society 44
St. John's House 44
St. Luke's Hospital 45
Temperance Association of Male Nurses, Ltd. 44
The Retreat, York 44

OFFICIAL NOTICES:—
Astley Cooper Prize 43
City of London Lying-in Hospital. 45
College of Preceptors 42
Guy's Hospital 43
Institute of Massage and Remedial Gymnastics 42
London School of Tropical Med... 42
North-East London Post-Graduate College 43
Queen Charlotte's Lying-in Hosp. 45
Royal College of Physicians and Royal College of Surgeons 43
University of Durham 45
York-road General Lying-in Hos.. 43

PARTNERSHIPS & PRACTICES. 52

RAILWAY & STEAMSHIP CO.'S.:—
Royal Mail Steam Packet Co. 45

TUTORS & LECTURERS:—
Weymouth 45

TRADE AND MISCELLANEOUS ADVERTISEMENTS

AMBULANCES:—
St. John Ambulance—Invalid Carriages 11

ANATOMICAL MECHANICIANS:—
Grossmith's Artificial Legs, Arms, Hands, and Eyes 10

BOTTLE MERCHANTS:—
Isaacs 53

CARRIAGES, MOTORS, &c.:—
Armstrong—Liveries 53
Beldam Tyre Co.—Beldam Tyres.. 11
Offord & Sons—Ford Cars 11
Singer & Co., Ltd.—Singer "10" Doctor's Car 11
Ware & De Freville—Motor Cars.. 11
Wylie—Motor Car 53

CHEMISTS & DRUGGISTS:—
Abbey Chemical Company—Beta Eucaine B.P. 39
Allen & Hanburys—Bynin Amara 21
Mercurial Cream, &c. 19
Allenburys Castor Oil 40
Anglo French Drug Co.—Rhéantine, Enterovaccin, Serums, Inalter Vial, &c. 26
Battley & Watts—Battley's Liquors 36
Boots Pure Drug Co.—Aspirin Compressed Tablets, &c. 30
British Oxygen Co.—Oxygen 40
Browning & Co.—Sempsotoin Emulsion with Iron 27
Burroughs Wellcome & Co.—Important Sera 24
Kharsivan, &c. 25
Christy & Co.—Ergcapiol 38
Clay, Paget & Co.—Glycolactophos 37
Duncan, Flockhart & Co.—Organo-Therapeutical Preparations 15
Fassett & Johnson—Emol-Keleet. 34

CHEMISTS—(Continued).
Gale & Co.—Elixir Cresolis c. Heroin Co., &c. 27
H. K. Mulford Company—Influenza Serobacterin 18
Haller—Maltose, Galactose, &c... 39
Heppells—Urodonal, Jubol, Globeol, &c. .. 18
Hewlett & Son—Hewlett's Specials 23
Horg & Son—Protein Nerve Food 40
Hudson's Eumenthol Chemical Co.—Eumenthol Jujubes 38
Humphrey Taylor & Co.—Junora 36
May & Baker—Arsenobillon and Novarsenobillon 13
Menley & James—Bacterol 13
Moore & Co., Ltd.—Lymm-Pure-Salt 40
Morrison & Co.—Digitamin 35
Parke, Davis & Co.—Pollacaine 17
Hay Fever Reaction Outfit 17
Raimes & Co.—Slinger's Nutrient Suppositories 40
Squire & Sons—Glycophocal, Ferocal, &c. .. Cover iv
Whiffen & Sons—Emetine 37
Wilcox, Jozeau & Co.—Kola Astier 38

DISINFECTANTS:—
Condy's Fluid 10
Hewlett & Son—Lysol 22
Quibell Bros.—Kerol 39

FOODS—
Allen & Hanburys—Allenburys Diet 20
Aylesbury Dairy Co.—Humanized Milk 41
Benger's Food 14
Blatchley's Diabetic Preparations 40
Cadbury's Cocoa 27
Carnrick & Co.—Dry Peptonoids. 25
Chymol Company—Chymol 28

FOODS—(Continued).
Frêemans Devonshire Custard.... 41
Glaxo 31
Hewlett & Son—Virophos 22
Hommel's Hæmatogen 35
Jardox Beef Food 41
Savory & Moore's Food 34
Valentine's Meat-Juice .. Cover ii

FURNITURE, &c.:—
Carters—Furniture for Invalids and Hospital Supplies 54

HOSPITALS (ISOLATION):—
Humphreys, Limited—Mobile Hospital Buildings, &c.. 33

MED. & SURG. APPLIANCES:—
Bailey & Son—Surgeons' Pocket Cases, &c. .... Cover iii
Davis—Lukens Sterile Catgut with Dulox Needle 10
Davis & Geck—Sutures fit for Surgery 40
Down Bros.—Spray for the Treatment of Burns .... Cover iii
Fassett & Johnson—Seabury's Gold Cross Cotton .. 12
Hearson & Co.—Hearson's Specialities 54
Leslies, Ltd.—Leslies' Zopia .... Cover ii
McBride & Co.—Kidney and Abdominal Protector 10
Millikin & Lawley—Osteology, &c. 10
Robinson & Sons—Gamgee Tissue 41
Timpson & Co.—Reliable Ligatures 9
Wormull—System of Aluminium Splinting 9

OPTICIANS:—
Watson & Sons, Ltd.—Microscopes 11

STATIONERY, &c.:—
Anderson & Son—Doctors' A/c Forms, &c. 52
Mabie, Todd & Co.—Swan Fountpens 9
Venus Pencils 53

TAILORS, BOOTMAKERS, &c.:—
Dowie & Marshall—Hygienic Bootmakers .. Cover ii
Evans & Co.—Service Uniforms .. 10
Harry Hall—Service Dress 53

VACCINE LYMPH:—
Chaumier's Calf Lymph 41
Heinemann—Rebman's Pure Asepic Calf Lymph 41
Jenner Institute for Calf Lymph 41
Renner's Calf Lymph Establishment 41

WINES, BEER, SPIRITS, &c.:—
Humphrey Taylor & Co.—"G. B." Diabetes Whisky 36

X-RAY, &c., APPARATUS:—
Mawson & Swan—X Ray Plates for Radiography 9
Medical Supply Association—Greville's Intensified Induction Transformers 32
Watson & Sons—Sunic X-Ray Plates 32

MISCELLANEOUS:—
Goddard & Smith—Electrical Appliances and Fittings 52
Murray, Bickerton road—Schall's Combined Galvanic and Faradic Battery 52
N.D., Wandsworth Common—Lady-Housekeeper 52
No. 345, L.O., Strand—Chauffeuse. 52
No. 347, L.O., Strand—Secretary.. 52

A Report
ON
TWENTY-FIVE CASES OF TETANUS.

(To the Medical Research Committee.)

BY H. R. DEAN, M.D. OXON., F.R.C.P. LOND.,
MAJOR, R.A.M.C. (T.).

(FROM THE 2ND WESTERN GENERAL HOSPITAL AND THE DEPARTMENT OF PATHOLOGY OF THE UNIVERSITY OF MANCHESTER.)

THE following notes are based for the most part on observations made on 25 cases of tetanus which have occurred during the last four months in the 2nd Western General Hospital. The majority of the men had been wounded in the battle of the Somme, and it is probable that almost all, if not all, had received prophylactic injections in France.

In all the cases the wounds had been at one time or another septic, but in 9 cases they had healed, or practically healed, at the time of onset of tetanus. In 13 cases the wounds had been of a severe nature, including considerable laceration of tissue. In four cases they were quite superficial. In one case tetanus followed 14 days after the re-amputation of what appeared to be a perfectly clean stump. That is to say, in at least 5 of the 25 cases the wounds were of such a nature that it is improbable that the most conscientious medical officer would have selected these men for further prophylactic injections. That the risk of tetanus is greater in the larger and more septic wounds is, no doubt, true as a general rule; nevertheless it can hardly be doubted that the administration of a prophylactic injection to every wounded soldier after his arrival in England, no matter how trivial his wound might appear, would be followed by a very substantial reduction in the number of cases of tetanus.

Of greater value as an indication for the administration of prophylactic injections than the mere extent of the wound or the amount of the discharge is the presence of a foreign body or the existence of a compound fracture. In either case there is likely to be dead tissue providing a focus for the multiplication of the tetanus bacillus, which is essentially a saprophyte with little or no capacity for growth in living tissue. A compound fracture was present in 11 of the 25 cases, in 2 a leg had been amputated, in 7 cases there was a history of removal of a bullet or fragment of shell, in at least 2 cases a foreign body was still in the tissues of the patient at the time of the onset of tetanus.

It was considered probable that tetanus would frequently occur in those cases in which the interval of time between the injury and surgical treatment at a casualty dressing station was considerable. The result of inquiries made on this point of the 25 patients is one of the points recorded in Table I. Comparatively few of the men remained untreated for any great length of time.

SIGNS AND SYMPTOMS.

It is well established that the course of tetanus is profoundly modified by prophylactic injection. The length of the incubation period in the 25 cases is recorded in Table I. In 10 cases the incubation period from the original date of the wound exceeded 50 days. The date of any operation was ascertained as far as it was possible by questioning the patient. In two cases only did signs of tetanus develop within 10 days of the date of an operation.

One result of the prolongation of the incubation period is that tetanus is likely to develop in patients whose wounds have healed and who have been transferred to hospitals for convalescents. These patients are naturally not under such constant medical supervision as are those whose wounds require attention several times during the day. The earliest signs of tetanus may in such cases be readily overlooked, and indeed are commonly not reported by the patient until they have persisted for some days. In several of these cases the disease was not recognised until symptoms had persisted for many days. The history of these cases shows the slow rate of progress of symptoms which is characteristic of many cases of tetanus occurring in persons who have received prophylactic inoculation. Not only do the prophylactic injections lengthen the incubation period, but they prolong, in many cases, the rate of onset and development of symptoms over a period of days and even weeks. This is a great advantage, as successful treatment is still possible after definite signs of tetanus have existed for several days. Nevertheless, the insidious character of the onset, and the apparently trivial nature of the early symptoms, may offer considerable difficulty in early diagnosis.

TABLE I.

No. of case.	Hours after wound before treatment at dressing station.	No. of days before onset of tetanus		Compound fracture (C. f.) or foreign bodies (F.b.) in wound.	Muscles involved.
		After wound.	After operation.		
1	¼ hour.	54	—	Nil.	Rt. leg, jaws, and neck.
2	¼ ,,	14	14	Shrapnel and trouser button.	Rt. arm, jaw, and neck.
3	14 hours.	18	18	Bullet; C. f.	Jaw and neck.
4	¼ hour.	87	70	Fragment of loose bone.	Jaw, back, legs, and neck.
5	¼ ,,	68	60	Fragments of bone.	Jaw and leg.
6	6 hours	127	31	Nil.	Jaw, neck, back, abdomen, and legs.
7	5 ,,	22	—	,,	Lt. leg, back, and abdomen.
8	¼ hour.	9	—	,,	Jaw, neck, and back.
9	¼ ,,	74	26	Septic stump.	Jaw, neck, back, and abdomen.
10	¼ ,,	82	80	C. f. lt. radius and femur.	Jaw, neck, lt. arm, face, and abdomen.
11	5 hours	12	10	Shrapnel.	Neck, jaw, back, abdomen, and legs.
12	12 ,,	64	—	C. f.	Jaw, neck, and lt. arm.
13	½ hour.	62	—	N.I.	Jaw, lt. hip, and abdomen.
14	½ ,,	12	10	Shrapnel.	Lt. biceps and vastus externus.
15	10 hours.	27	14	Amputation.	Jaw.
16	7 ,,	45	—	F. b. not yet removed.	Jaw, neck, and lt. leg.
17	½ hour.	13	11	Fragments of shell.	Neck, face, abdomen, and back.
18	26 hours	17	15	C. f. tibia and fibula.	Jaw, neck, back, abdomen, legs.
19	¼ hour.	68	—	Nil.	Rt. ham-strings, jaw, and neck.
20	28 hours.	91	—	C. f. shrapnel.	Jaw, neck, abdomen, and rt. leg.
21	1 hour.	10	8	Shrapnel.	Back, abdomen, and rt. leg.
22	26 hours.	18	17	C. f. olecranon; fragment of bone removed.	Jaw, neck, and forearm.
23	25 ,,	102	100	C. f. tibia and fibula.	Jaw, lower spine, abdomen, lt. thigh, and calf.
24	¼ hour.	50	5	C. f.; shrapnel.	Jaw, neck, l. leg, back, and abdomen.
25	1 ,,	59	—	C. f.; F. b.	Jaw, neck, back, abdomen, and lt. leg.

The earliest signs are often localised to the immediate neighbourhood of the infected wounds, and it is possible that this localisation is a result of the prophylactic inoculation. Nevertheless, in 11 cases stiffness of the jaw and neck was the earliest recorded symptom.

The muscles in the immediate vicinity of the wound may twitch or show irregular clonic contractions. A slight tap increases the violence of such contractions, and may cause a spread to adjacent groups of muscles. In other cases the earliest observed sign has been a tonic contraction of a group of muscles, usually a flexor group, near the wound. These patients complained of stiffness and pain in one or more limbs, and in some cases a diagnosis of rheumatism or muscular rheumatism was made. It is perhaps worthy of note that 6 of the 25 patients were treated with sodium salicylate or aspirin during the period of onset. The condition may remain strictly localised for days and even weeks. There is usually a gradual spread to adjacent groups of muscles, but in some cases, even in the absence of serum treatment, there appears to have been but little change in the symptoms from day to day.

Sooner or later, however, in the majority of cases the signs become generalised—that is to say, other groups of muscles far removed from the site of the wound become involved.

The muscles most frequently involved appear to be the masseters, the posterior cervical muscles, the muscles of the anterior abdominal wall, the spinal muscles in the dorsal and lumbar region, the flexors of the hip-, knee-, and ankle-joints. In 3 cases there was spasm of the facial muscles. With the exception of those cases in which there was a wound of hand or arm the muscles of the upper extremity escaped. The groups of muscles involved in each of the 25 cases are shown in the table. It will be seen that the masseters were affected in 21 cases. The degree of spasm varied considerably. In no case were the jaws absolutely closed, and in a few cases there was only a little stiffness of the masseters. Stiffness of the posterior cervical muscles is an early sign of generalisation, and from the muscles of the neck the spasm usually spreads downwards to involve the muscles of the dorsal region. Extreme rigidity of the abdominal muscles is often a marked feature.

The reflexes of the lower limbs are commonly exaggerated. The knee-jerk is violent and may be followed by tremors or clonic contractions of the quadriceps extensor. There is an exaggerated response to plantar stimulation, involving as a rule all the muscles of the leg and thigh, and in some cases producing spasm of the lumbar muscles. Occasionally there is, in addition, a crossed response with spasmodic contractions of the muscles of the other leg. Ankle clonus can sometimes be obtained. It would be anticipated that the knee-jerk would not be obtained in cases in which there was spasm of the hamstring group. In some cases this anticipation was fulfilled, in others stimulation of the patellar tendon produced a sharp contraction of the quadriceps extensor, followed almost immediately by a violent spasm of the hamstrings. The effect produced was that of a double jerk. With the exception of those cases in which tetanus originated in the muscles of the upper limb, the triceps jerks were increased in two cases only.

In severe and advanced cases the posture was often characteristic. The patient usually preferred to have his shoulders supported by pillows. The back was somewhat arched, the head retracted, the shoulders were thrown back, and the weight of the body was partly supported on the back of the upper arms and elbows. In more advanced cases definite opisthotonos was observed.

Other signs which accompanied generalisation of the spasms were profuse perspiration and a quickening of the pulse-rate. Many of the patients were convalescents and the temperature was normal at the time of onset of symptoms, and remained at normal or a little above normal throughout the attack of tetanus. In these cases the association of a pulse of 100 to 130 with a normal temperature (11 of the 25 cases) was rather striking. Within about 48 hours of the intravenous injection of an adequate dose of antiserum the pulse-rate begins to fall rapidly, although no amelioration of the spasm may be apparent until several days later. Under these conditions the fall of the pulse-rate is probably the earliest indication of successful serum treatment.

Generally speaking, the 25 cases may be classified in three groups.

1. Four cases in which the spasm remained localised to the muscles in the neighbourhood of the wound.

2. Ten cases in which the spasms commenced in the neighbourhood of the wound and remained for a time localised. After a variable interval generalisation occurred.

3. Eleven cases in which there was no history of preliminary local spasms, and the disease commenced suddenly by involvement of the jaw and neck muscles.

MILD CASES TREATED ENTIRELY BY INTRAMUSCULAR INJECTIONS.

In 5 cases serum treatment was confined to intramuscular injections. All were of a mild type and all made uneventful recoveries. Three cases (Nos. 14, 21, and 22) had received prophylactic injections after admission to the 2nd Western General Hospital, and the duration of the disease was very short. In very mild cases intramuscular injections are quite sufficient, and they have the great advantage of being devoid of risk. A dose of 10,000 units, followed at three-day intervals by a second and third dose, each of 5000 units, is probably quite enough for cases in which the signs are localised to the vicinity of the wound.

CASE 14.—Wounded on Sept. 25th. On Oct. 24th there was an exceedingly septic wound of knee-joint. On Oct. 28th a prophylactic injection of 1000 units was given. On Nov. 6th twitching of biceps and vastus externus was observed. An intramuscular injection of 5000 units was given. The signs were localised to the hamstring muscles, and were more marked on the left side. The contractions were irregular and fibrillary. Plantar reflexes exaggerated; knee-jerks normal. The spasmodic contractions ceased within a few days.

CASE 21.—Wounded on Nov. 21st (by shrapnel) in lumbar region, right thigh, and right upper arm. The wounds were suppurating on admission to 2nd Western General Hospital. A prophylactic injection of 500 units was given on Nov. 26th. Complained of severe pain in back on Dec. 7th and 8th. On Dec. 13th tonic spasm of lumbar and abdominal muscles. An intramuscular injection of 3000 units was given. On Dec. 14th rigidity of lumbar muscles with occasional painful spasms. Knee-jerks and plantar reflex exaggerated on right side and ankle clonus. Plantar reflex exaggerated on left side but not knee-jerk. 4500 units were injected on Dec. 14th, 3000 on Dec. 22nd, and 1500 on Dec. 30th. On Dec. 28th a piece of shell was removed. Spasms ceased after this date.

CASE 22.—Wounded on Nov. 29th. On Dec. 8th there was an exceedingly septic wound of left elbow with compound fracture of olecranon. On Dec. 9th a prophylactic injection of 1500 units was given. On Dec. 16th spasm of masseters, stiffness of neck muscles, and slight tremor of muscles of forearm were observed. An intramuscular injection of 3000 units was given, and the signs had completely disappeared within a week.

CASE 5.—Wounded on August 8th and left foot amputated close above ankle on following day. Arrived in Manchester on Sept. 17th with septic stump on left side and septic wound of right heel, with compound fracture of os calcis. On Oct. 15th patient complained of stiffness of jaw, which he had first noticed three days earlier. On Oct. 16th there was definite spasm of masseters; knee-jerks exaggerated. No sweating. P. 72; T. normal. An intramuscular injection of 10,500 units was given. On Oct. 18th there were pain and stiffness of thighs and back. On Oct. 20th improvement began; recovery rapid and uneventful.

CASE 16.—Wounded on Oct. 8th. Wounds of left axilla, left thigh, leg, and foot. On Nov. 18th a foreign body was detected by X rays near tibia on interosseous membrane. On Nov. 10th left big toe began to twitch. During next week twitching was noticed in muscles of leg. On Nov. 18th complained of stiff jaw. On Nov. 22nd definite spasm of jaw and neck muscles. Knee jerks exaggerated and followed by clonic contractions of quadriceps extensor. Plantar reflexes exaggerated. Fibrillary contractions of gastrocnemius and hamstrings on left side. 5000 units were injected on Nov. 22nd and again on Nov. 25th. Recovery uneventful.

CASES IN WHICH AN INTRATHECAL INJECTION WAS GIVEN.

In six cases an intrathecal injection of serum was administered.

CASE 1.—Wounded on August 4th. There was a perforating wound on left upper arm, wound of right thigh, and superficial wounds below left knee. Was sent to convalescent hospital on August 16th. He was up and out every day until Sept. 17th, when he noticed stiffness of right leg which steadily increased during next ten days. On Sept. 27th remained in bed and complained of stiffness of jaw and neck and pain in small of back. Cramps in right leg began the same evening. At 8.30 P.M. he was sweating profusely; T. 99°, P. 104. All wounds had completely healed. Jaw and neck muscles tense, right thigh, knee and ankle flexed, tonic spasm of hamstrings, unable to straighten leg. Painful spasms occurred every 10 minutes in hamstrings. On tapping right patellar tendon violent spasm of quadriceps extensor which was cut short and followed by violent contractions of hamstring group. Archilles jerk and plantar reflex exaggerated. Reflexes of left leg exaggerated but not to same extent. Triceps and supinator jerks increased on both sides. Percussion note was dull over lower lobe of lung on both sides; numerous crepitations heard. An intrathecal of 5000 units and intramuscular injection of 10,000 units were given. On Sept. 28th intrathecal injection of 5000 units. Patient died on evening of Sept. 29th; immediate cause of death pneumonia.

CASE 2.—A report[1] of this case is published separately by Mr. J. Gow. There was very intense spasm of flexors of right wrist and metacarpus, accompanied by stiffness of muscles of neck and jaw. Three intrathecal injections were given. Owing to the fact that the most intense symptoms suggested an involvement of the cervical enlargement, two of these injections were given by inserting a needle between the first and second dorsal vertebræ. The intrathecal were supplemented by numerous intramuscular injections. Patient made a good recovery; after which a metal trouser button made its way out from between thumb and index finger of right hand. The chief seat of spasm had been the flexor muscles of right wrist and metacarpus.

CASE 6.—Wounded on June 2nd. On arrival in Manchester there were numerous small, superficial, suppurating wounds of buttock and right thigh. All these healed except small sinus in perineum, which was opened up on July 25th and on Sept. 16th. On Oct. 17th patient is said to have choked and had what was described as a fit. Stiffness of neck and jaw was observed. On Oct. 18th he was sitting propped up in bed; T. 97·8°, P. 110. Perspiration profuse. Spasm of muscles of jaw, neck, back, and abdomen. Knees slightly flexed and increased tone of hamstring muscles. Knee-jerks and plantar reflexes exaggerated. An intravenous injection of 30,000 units was given. On Oct. 20th intrathecal injection of 10,000 units at 10 P.M. At 2 A.M. on Oct. 21st a series of violent convulsions occurred with violent spasmodic movements of the limbs. Patient became completely unconscious and remained so until the evening. The convulsions, controlled to some extent by chloroform, continued throughout the day. T., normal before intrathecal injection, rose to 102·4°. Patient's condition remained very critical for 24 hours. On Oct. 22nd he was rather better. Signs of septic bronchopneumonia developed on Oct. 28th and he died on Nov. 28th. The convulsions which followed the intrathecal injection were probably of cerebral origin and were almost certainly the result of the injection. The pneumonia was probably the result of inhalation of septic particles during the period of unconsciousness.

CASE 7.—Wounded on Sept. 26th. On arrival in Manchester on Oct. 4th had large open granulating wound of left thigh. On Oct. 18th and 19th clonic spasms of left quadriceps extensor were observed with slight stiffness of left hip and back. On Oct. 20th he was sitting up in bed with left hip fixed and knee extended. Tonic spasm of quadriceps extensor. Occasionally spasms spread to lumbar muscles. Slight perspiration; T. 98·8°, P. 80. Jaw muscles normal and reflexes not increased. An intrathecal injection of 5000 units was given. During Oct. 21st violent spasms of quadriceps every 20 seconds were observed. Subcutaneous injection of 1000 units. On Oct. 22nd spasms were less frequent; intrathecal dose of 4500 units. On Oct. 23rd spasms less violent. At 7.30 P.M. on Oct. 24th a sudden spasm or convulsion occurred in which chin was drawn down on to sternum. There had

[1] The report of the case appears on p. 639 of this issue.

been at no time any tonic spasm of jaw or neck muscles. Patient became delirious and shortly afterwards comatose. He died in state of deep coma with stertorous breathing about 8 P.M. At autopsy extreme venous congestion of viscera found; heart dilated and filled with blood; lumbar cord coated with pus.

CASE 8.—Wounded on Oct. 7th. On Oct. 13th he had numerous small superficial and rather dirty wounds at back of right calf, a superficial wound on outer aspect of right thigh, and superficial wounds of buttock. Tetanus began with stiffness of jaw and neck on Oct. 16th and 1500 units were injected beneath skin. On Oct. 17th intrathecal injection of 5000 units. On Oct. 20th tonic contraction of muscles of jaw, neck, and back. Intramuscular injections of 10,000 units on Oct. 20th, 4500 units on Oct. 26th, and 6000 units on Oct. 28th. Patient made uneventful recovery.

CASE 19.—Wounded on Oct. 2nd. There were multiple wounds of right thigh, all of which had completely healed at time of onset of tetanus. On Dec. 6th patient noticed pain in right leg, but did not complain until Dec. 9th. On Dec. 10th intrathecal injection of 1000 units was given. Before injection T. 98° and P. 86, after injection T. 102° and P. 88. He complained of violent headache and severe pain in back. He was restless; twitching of muscles of face and leg observed. On Dec. 11th tonic contraction of hamstrings and gastrocnemius on right side. Knee and hip flexed and foot arched. Knee-jerk could just be obtained; it was very exaggerated on left side. Muscles of neck, but not of jaw, were stiff. The following intramuscular injections were given: Dec. 11th, 10,000 units; Dec 15th, 5000 units; Dec. 19th, 5000 units; and Dec. 24th, 3300 units. Improvement was very slow and spasm of hamstring has not yet entirely disappeared.

THE INTRAVENOUS METHOD.

Fourteen cases were treated on the day of notification by the intravenous injection of serum under chloroform anæsthesia. The condition of the patient was serious at the time of injection in all these cases, and the signs of tetanus were well marked. In 13 there was well-marked stiffness of jaw, in 1 slight but definite spasm of the masseters. In 10 cases there was spasm of muscles of neck, in 9 of muscles of back, in 7 of abdominal muscles. Opisthotonos was present in 6. In 12 the knee-jerks and plantar reflexes were exaggerated. That is to say, in all the 14 cases the signs were well advanced, and had ceased to be limited to the muscles of the locality of the wound. One patient died and 13 recovered.

The serum was given in one dose, 30,000 U.S.A. units, and the volume of the injection varied from 120 to 190 c.c. Injections were given with a 20 c.c. "Record" syringe fitted with the two-way tap and tube recommended by Graham for the intravenous injection of eusol. The method employed was as follows:—

A glass pint measure being sterilised, into it were emptied 22 small serum flasks, each of which contained 1500 units. Some of the serum was inevitably wasted, which was compensated by the two extra flasks of serum. The measure was placed in a basin of warm water. The patient was anæsthetised with chloroform and a thin rubber bandage was used to constrict slightly the upper arm and render the veins prominent. The skin in front of the elbow was sterilised, usually with iodine. The end of the rubber tube was held in the serum by an assistant and the syringe was filled and emptied several times to get rid of air bubbles. The syringe was then half filled with serum and the needle inserted into the most prominent vein. The piston was then slightly withdrawn until blood appeared in the syringe and it was certain that the needle was in the lumen of the vein. The serum was then injected.

One patient died while still under the influence of the anæsthetic, but there was no reason to think that death was due to anaphylaxis. An abstract of this case will be found below. Of the remaining 13 patients one showed signs of collapse on recovering from the anæsthetic and was a source of some anxiety for about 24 hours. In the other 12 cases the condition of the patient after the injection was perfectly satisfactory. In 5 cases an urticarial eruption was noticed within a few moments of the injection, in 2 œdema of the eyelids.

Cases Treated by a Single Intravenous Injection of 30,000 Units of Antitoxin.

In 4 of these cases the entire serum treatment consisted of a single intravenous injection of 30,000 units. In the remaining 10 cases intramuscular and subcutaneous injections were also given, but the amount so given was, in the majority of the cases, comparatively small. (Table II.)

CASE 3.—Wounded on Sept. 15th. At time of onset septic wound of left orbit and septic wound of right shoulder. Jaw had been stiff on Oct. 1st and 2nd, but the patient had not complained. On Oct. 3rd, T. 103·6°, P. 114; profuse perspiration, incontinence of urine, marked trismus, neck muscles stiff, abdominal muscles normal, knee-jerks and plantar reflexes increased. Was given intramuscular injection of 9000 units and intravenous injection of 37,500 units. On Oct. 4th intramuscular injection of 6500 units. Steady improvement from Oct. 7th. All signs had disappeared by Nov. 16th. This patient was under the care of Captain E. D. Telford, to whom I am indebted for permission to publish the case.

CASE 4.—Wounded on July 18th. On July 31st very septic wound of inner and front aspect of left forearm, compound fracture of ulna. August 4th: Fragment of bone removed. Sept. 22nd: Wound almost completely healed. Oct. 6th: Pains in limbs treated with sod. salicylate. Oct. 13th: Muscles of neck stiff, difficulty in opening mouth; was given subcutaneous injection of 1500 units. Oct. 14th: T. 99°, P. 120. Profuse perspiration; unable to open mouth, muscles of neck and upper dorsal region very stiff with frequent spasms. Knee-jerks, right triceps jerk abdominal and plantar reflexes exaggerated. Wound closed except for very small area covered by granulation tissue. Intravenous injection of 30,000 units. Half an hour after injection profuse urticaria. No change for next four days. Oct. 19th: Profuse urticaria, pains in head, dazed and confused, conjunctivæ injected, for a period of 1½ hours violent spasms of back muscles occurring every 15 minutes, subsequently less frequent. Oct. 20th: Great improvement, no spasms. Subsequently uninterrupted recovery. No serum given except the intravenous injection of 30,000 units.

CASE 9.—Wounded on August 6th. Circular amputation middle of right thigh. Re-amputation Sept. 9th. Secondary hæmorrhage on numerous occasions. Wound very septic until Sept. 22nd, after which date marked improvement. Oct. 19th: Jaw slightly stiff. On morning of Oct. 20th twitching of back muscles observed and subcutaneous injection of 4500 units given. At 6 P.M. T. 101°, P. 140. Sweating slightly, jaws stiff but could open mouth a little. Neck and abdominal muscles rigid, left knee-jerk increased and followed by spasm. Exaggerated plantar reflex. Intravenous injection of 30,000 units. No great change until Oct. 25th, when 10 c.c. of cerebro-spinal fluid were withdrawn by lumbar puncture and an intramuscular injection of 5000 units was given. Oct. 26th: Considerable improvement. Oct. 27th: Intramuscular injection of 4500 units. Subsequently steady improvement. All signs had disappeared by Nov. 8th, on which day 1000 units were injected into muscles. Serum rash observed Oct. 23rd.

CASE 10.—Wounded on July 30th. Shell wounds left thigh and left forearm, compound fracture left radius and left femur. Wounds were very septic but great improvement had taken place, and wound of arm had completely healed. On night of Oct. 20th signs of tetanus developed very suddenly. On Oct. 21st sweating freely and in great pain. Spasm of facial and jaw muscles. Neck and abdominal muscles rigid. Knee-jerk exaggerated and followed by tremor. Plantar reflex exaggerated. Intravenous injection of 30,000 units. During next 24 hours generalised spasms were frequent. Oct. 23rd and 24th, slight improvement. Oct. 25th, 10 c.c. of cerebro-spinal fluid were removed by lumbar puncture and 5000 units injected into muscles. Oct. 27th, cerebro-spinal fluid was again withdrawn by lumbar puncture and an intramuscular injection of 4500 units given. Improvement followed lumbar puncture on both occasions. After Oct. 28th improvement slow but continuous; all signs had disappeared by Nov. 24th. Injections of 1000 units given on Nov. 4th, 6th, 8th, 13th, and 16th. Serum rash observed on Oct. 24th.

CASE 11.—Wounded on Oct. 7th. Patient noticed "twitching" of left leg on Oct. 19th. This was worse on Oct. 20th, but he made no complaint until Oct. 22nd. On Oct. 21st jaw had felt stiff. On Oct. 23rd T. 97°, P. 130. Profuse perspiration, paresis of left side of face, tonic contraction of masseters, could just protrude tip of tongue, neck muscles stiff, abdominal muscles rigid. Left hip, knee, and ankle flexed; tonic spasms of hamstrings and calf muscles of left leg. Occasional spasms spread up to lumbar and lower dorsal muscles causing slight arching of back and lifting buttock from bed. Plantar reflexes and right knee-jerk exaggerated. Intravenous injection of 30,000 units under chloroform anæsthesia. Subsequent intramuscular injections of 4500 units on Oct. 31st, 2000 units on Nov. 13th, and 4000 units on Nov. 22nd. Made a good and uneventful recovery. No signs of tetanus after middle of November.

CASE 12.—Wounded on August 18th. Complained of pains in back and chest on Oct. 20th. Was treated with aspirin, but pain continued on Oct. 21st and 22nd. Complained of sore throat and stiffness of neck and back on Oct. 23rd, and a subcutaneous injection of 1,500 units was given on Oct. 23rd and 24th. On Oct. 25th patient was in great pain and sweating profusely. T. 98·8°, P. 112. Slight stiffness of jaw muscles, but could open mouth pretty well. Tonic spasm of neck and upper dorsal muscles. Knee-jerks, plantar reflexes, and right triceps jerk exaggerated. The left elbow was fixed as the result of injury. Intravenous injection 30,000 units under chloroform anæsthesia. Rapid recovery; all signs had disappeared by Nov. 15th. On Oct. 30th subcutaneous injection of 1500 units.

CASE 13.—Wounded on August 18th. Complained of backache on Oct. 19th; was treated with aspirin, which relieved the pain. On Oct. 23rd, complained of pain in back and difficulty in opening mouth. On Oct. 25th definite spasm of muscles of jaw; intramuscular injection of 1000 units. After this spasm of jaw and pain in back became more marked, and on Oct. 29th 1500 units were injected into the muscles. On Oct. 30th two generalised spasms involving muscles of limbs and trunk and accompanied by cyanosis, feeble pulse, and profuse perspiration. On Oct. 31st patient was sitting propped up in bed, head thrown back and back somewhat arched. Tonic spasm of neck and back muscles. Masseters tense, but could open mouth a little. Abdominal muscles rigid. Left hip forcibly flexed; tonic contraction of left hamstrings; knee half flexed; tonic spasm of calf muscles. Exaggerated plantar reflex. On tapping patellar tendon violent spasm of quadriceps extensor was produced, but the resulting knee-jerk was cut short by powerful spasm of hamstrings. On right side both knee-jerk and plantar reflex exaggerated. Intravenous injection of 30,000 units under chloroform anæsthesia. No more doses of serum were given. Uneventful recovery; all signs of tetanus had disappeared by Nov. 20th.

This case had several features of interest. There was a long incubation period (62 days). The symptoms came on slowly and insidiously, and the diagnosis remained in doubt for a long period. The symptoms gradually became more definite, and the condition was ultimately typical of tetanus of a severe type. A single large dose of antitoxin injected into a vein resulted in a satisfactory cure.

CASE 15.—Wounded on Oct. 12th. A circular amputation was performed on Oct. 14th, and on Oct. 21st patient was admitted to 2nd Western General Hospital with what appeared to be a perfectly clean surface to the stump. A Farabeuf's operation was performed on Oct 25th. Slight stiffness of jaw was noted on Nov. 8th, and was worse

on Nov. 9th. On Nov. 10th patient was sweating profusely. T. 100°, P. 120. Tonic spasm of masseters, patient being just able to protrude tip of tongue. No other group of muscles was involved. Knee-jerks and plantar reflexes normal. 30,000 units were injected into an arm vein under chloroform anæsthesia. This was the only dose of serum given. Rapid and uneventful recovery; all signs had disappeared by Nov. 25th.

CASE 17.—Wounded on Nov. 13th. Wound of right thigh and right upper arm and shoulder, and of right side of chest. Admitted to 2nd Western General Hospital on Nov. 20th, when all wounds had closed except small wound in arm. Nov. 25th patient began to spit up blood. On examination percussion note over right lower lobe of lung was found to be dull and breath sounds absent. Œdema of chest wall was observed. Nov. 26th, complained at 6 P.M. of difficulty in swallowing and opening mouth. At 10 P.M. he appeared to have a generalised spasm and bit his tongue. He was sweating profusely and had difficulty in opening mouth. Intramuscular injection of 3500 units was given. During night he became rapidly worse and several violent spasms occurred during which respiratory movements ceased and he became very cyanosed. At noon on Nov. 27th he was sitting propped up in bed with his head retracted. The movements were stiff and the muscles of neck and upper dorsal region were rigid. Knee-jerks and plantar reflexes normal. Any movement or effort caused violent spasm involving muscles of spine, neck, and to a less extent facial muscles. About 12.15 he had a violent and prolonged spasm during which respiratory movements ceased and he became very cyanosed. After prolonged artificial respiration breathing was re-established. His condition was then very serious, as the prolonged spasm had added greatly to the difficulties of a heart already embarrassed by the conditions present in the right pleural cavity. The signs of tetanus had, however, progressed so rapidly that it was felt that intravenous injection of a large dose of serum offered the only prospect of cure. The patient was anæsthetised and the cyanosis and respiratory difficulty increased. Venesection was performed, but the flow of blood was poor. An intravenous injection of 30,000 units was given. A few minutes later the cyanosis increased and respiratory movements ceased and the patient died. Death was due to heart failure, the result of the wound of lung, and the tetanic spasms involving the respiratory muscles. There was no reason to attribute death to anaphylaxis.

CASE 18.—Wounded on Nov. 13th. On morning of Dec. 2nd unable to open mouth. Slept well on following night. On Dec. 4th spasms of muscles of face, neck, and upper dorsal spine commenced at 7 A.M. An intramuscular injection of 6000 units was given. The condition at 6 P.M. was as follows: T. 98°, P. 120. Masseters, muscles of back and neck, dorsal and abdominal muscles rigid. Right knee-jerk exaggerated and followed by clonus of quadriceps extensor, exaggerated plantar reflex, ankle clonus. Triceps jerk somewhat exaggerated on both sides. Spasms every few minutes producing arching of back. At 7 P.M. under chloroform anæsthesia 30,000 units (140 c.c.) were injected into a vein. As the patient recovered from the anæsthetic œdema of eyelids was noticed and a profuse urticarial rash appeared over face and hands and upper part of chest. The pulse became rapid and was of poor volume. The face was pale and the respirations shallow. A hypodermic injection of ether was given. Signs of shock had practically disappeared the next day. For the next few days there was little change except that spasms gradually became less frequent. On Dec. 9th definite improvement commenced, and signs of tetanus had almost disappeared by Dec. 19th.

CASE 20.—Wounded on Sept. 3rd. Seven weeks later a piece of shrapnel was removed. Was sent to convalescent hospital on Nov. 3rd. Here he was out every day until Dec. 3rd, when he complained of cramp in his leg. On Dec. 4th he was treated with aspirin. The pain, however, got gradually worse, and after Dec. 8th he remained in bed. On Dec. 9th he had difficulty in swallowing and complained of stiffness of jaw; T. 98·8°, P. 116. 2000 units were injected into the muscles. On Dec. 10th spasms of muscles of back had commenced. Intramuscular injections of 2000 units were given on the 10th, 11th, 12th, and 13th. On Dec. 13th the condition was as follows: T. 98·4°, profuse perspiration, sitting propped up in bed, jaw very stiff but could open mouth a little. Muscles of neck, spine, and abdomen rigid. Every few minutes spasm of spinal muscles producing arching of back. Right hip and knee flexed and foot arched. Tonic spasm right hamstrings and gastrocnemius. Right knee-jerk could not be obtained. Left knee-jerk exaggerated and followed by tremor of quadriceps extensor. Left plantar reflex exaggerated. Intravenous injection of 30,000 units (185 c.c.) under chloroform anæsthesia. Colour and respiratory movement remained good throughout, and after the injection. At the end of injection pulse quickened to 116; temperature 98°. There was no sign of shock. Immediately after the injection a profuse urticarial rash appeared which was most marked on hands, face, and neck. There was well-marked œdema of eyelids. The rash faded in about 10 minutes, and the œdema of eyelids subsided shortly afterwards. It will be observed that this patient had had intramuscular injections of serum on Dec. 9th, 10th, 11th, 12th, and 13th, and if such injections are capable of effecting so-called desensitisation it is remarkable that the urticaria and œdema of eyelids should have been observed. No further injections of serum were given. Patient began to show marked improvement after Dec. 16th, and signs of tetanus had disappeared by Dec. 21st.

CASE 23.—Wounded on Sept. 3rd. Compound comminuted fracture of left tibia and fibula. On Dec. 14th patient complained that his toes were gripping the end of the splint. On Dec. 16th he complained of increased pain in leg and was treated with aspirin; morning T. 97°, P. 104, evening T. 97·2°, P. 122. Dec. 17th, T. 97°, P. 114. Condition on Dec. 18th was as follows: Sweating profusely, P. 120. Tonic spasm of calf muscles on left side, toes sharply flexed on splint. Abdominal muscles hard, very slight spasm of masseters. Right knee-jerk exaggerated and followed by clonic contraction of quadriceps extensor. Plantar reflex exaggerated. Every five minutes spasm of muscles of thigh. These spasms occasionally spread to lumbar and lower spinal muscles, lifting the buttock from the bed. Intravenous injection of 30,000 units (150 c.c.) under chloroform anæsthesia. Uneventful recovery.

CASE 24.—Wounded on Oct. 20th. Foreign body removed from leg on Dec. 4th (500 units had been injected on Dec. 3rd). Complained of sore-throat on Jan. 7th. Inflammation of fauces, swelling of neck, and enlargement of lymphatic glands observed. On Jan. 9th complained that neck was stiff. Jan 10th, neck very stiff, jaw slightly stiff. Condition on Jan. 11th: T. 98°, P. 106, sweating, complained of pain in neck. Masseters in tonic contraction but could open mouth a little. Neck, upper dorsal and abdominal muscles rigid. Plantar reflexes exaggerated, knee jerks normal. At intervals of few minutes spasms of spinal muscles during which back was arched and body rested on back of head, buttock, and elbows. An intravenous injection of 30,000 units was given under chloroform anæsthesia. The patient began to improve on Jan. 15th, and had quite recovered by the first week in February. No further dose of serum was given.

CASE 25.—Wounded on Nov. 5th. Was up and going out daily during December. Patient noticed that his jaw was stiff on Jan. 3rd, but made no complaint. The jaw remained about the same until Jan. 10th, when he complained of severe pain in the shoulders. He was treated with sodium salicylate. On Jan. 11th a few spasms of neck and back occurred. During next night spasms became frequent and very painful. Condition on Jan. 12th: T. 97°, P. 88. Sweating profusely and in great pain. Tonic spasm of masseters, but just able to protrude tip of tongue. The patient was lying in bed with his head and shoulders propped up. The back was arched and weight of body rested on back of head, buttock, and backs of elbows. Abdominal muscles rigid. Left leg was extended and rather stiff; knee jerk and plantar reflexes increased. The right knee was still bandaged, a wound in this situation being still unclosed. All other wounds were healed. Every four minutes painful generalised spasms occurred, arching of back was accentuated, and buttocks and thighs lifted from bed. An intravenous injection of 35,000 units was given under chloroform anæsthesia. A few minutes later an urticarial rash appeared. Next day there was little change in the general condition, but the spasms were rather less frequent. Definite and rapid improvement commenced about one week after the injection. No further injections were given, and all signs of tetanus had disappeared by Jan. 28th. A swelling appeared in the neighbourhood of the wound of knee about Jan. 20th, and it seemed probable that there was a sequestrum in this situation. An X ray examination revealed the presence of several foreign bodies.

TABLE II.

No. of case.	Interval between last serum injection and intravenous injection.	Serum given in treatment before or after intravenous injection of 30,000 units.		Signs of anaphylaxis.
		Before.	After.	
3	7 hours.	9,000 (M)	6,500 (M)	0
4	24 ,,	1,500 (S)	0	Urticaria.
9	6 ,,	4,500 (M)	10,500 (M)	0
10	83 days.	0	12,500 (M)	0
11	8 hours.	4,500 (M)	10,500 (M)	0
12	24 ,,	3,000 (S)	1,500 (S)	0
13	48 ,,	2,500 (S)	0	Urticaria.
15	30 days.	0	0	0
18	6 hours.	6,000 (M)	5,000 (M)	Urticaria, œdema of eyelids, feeble pulse, shock.
20	9 ,,	10,000 (M)	0	Urticaria and œdema of eyelids.
23	98 days.	0	0	0
24	39 ,,	0	0	0
25	69 ,,	0	0	Urticaria.

The figures indicate units of antitoxin. M = Intramuscular; S = Subcutaneous.

Note.—In the case of the long intervals the number of days indicates the period between the prophylactic and the intravenous injection. The short intervals occurred in cases in which serum treatment had been commenced before the intravenous injection.

OBJECTS OF SERUM TREATMENT.

The symptoms of tetanus are in themselves evidence that the toxin has reached and has begun to act on the central nervous system. Even if a diagnosis is made at the earliest possible moment it is obvious that serious damage has already been done. Before discussing the merits of alternative methods it seems desirable to define the objects which it is hoped to effect by the therapeutic use of antitoxin. The possible results of serum treatment fall under two headings.

1. To neutralise and destroy all the free toxin which is circulating in the blood and tissues, and to maintain in the blood and lymph such a concentration of antitoxins as shall be sufficient to neutralise the subsequent output of toxin from the infected focus.

2. To endeavour to obtain such a concentration of antitoxin in the central nervous system as shall serve to dissociate the toxin which has already reached the nerve cells.

It is improbable that the second object can be attained, but since it is generally held that tetanus toxin reaches the central nervous system by way of the peripheral nerves it is no doubt desirable to maintain a sufficient supply of antitoxin in the tissues of the central nervous system, in order that the toxin may be neutralised as it arrives, and before it is able to damage the nerve cells.

The all-important object of serum treatment, and the object which can certainly be attained, is the neutralisation of toxin before it reaches the central nervous system, and consequently the method which should be used is that which permits us to saturate as rapidly as possible all the tissues of

the body with antitoxin. The method which fulfils these conditions is the intravenous method. Very large quantities of serum (200 c.c.) can be introduced into a vein, and are certainly and rapidly distributed throughout the body.

After subcutaneous and intramuscular injections the absorption of the serum is relatively slow, and valuable time is lost. Moreover, it is not convenient to inject a very large volume of serum beneath the skin or into the muscles, for the resulting swelling is not without pain to the patient. The more serious objection to these two methods is, however, the interval which must elapse before the antitoxin is absorbed. As regards the size of dose, it is obvious that the intrathecal method of injection is the least advantageous, for unless the serum contains a relatively large number of antitoxin units to the cubic centimetre the dose which can be given with safety is comparatively small. The advantage claimed for the intrathecal method is, that the antitoxin introduced by this route reaches most rapidly the essential seat of the mischief—the cells of the central nervous system.

The cerebro-spinal fluid is said to be secreted by the choroid plexus and is probably absorbed and carried away by the cranial sinuses and meningeal veins. Its chemical composition is chiefly remarkable for its low protein content, in which respect it differs markedly from lymph. The separate existence of lymphatic channels in the central nervous system has apparently not been proved or definitely disproved, and it is sometimes stated that the cerebro-spinal fluid plays to the central nervous system the part which is played by lymph to other organs of the body. But the lymph in other parts of the body acts as a middleman between the blood and the cells. If the central nervous system is devoid of true lymph, and if all the functions of lymph are discharged by the cerebro-spinal fluid, then the cells of the various regions of the brain and cord are entirely dependent on a fluid secreted by a comparatively small gland (the choroid plexus) and from a comparatively insignificant blood-supply. But all parts of the brain and cord are richly supplied with arteries and capillary vessels which form a basket-like plexus around the nerve cells of the grey matter, and it is probable that the capillaries of the central nervous system perform the same functions as capillaries in other parts of the body. It seems reasonable to assume that antitoxin can pass from the vessels to the tissues in the brain and cord as freely as in other organs.

It is said that antitoxin which is injected into the blood-stream does not reach the cells of the central nervous system because, after an intravenous or intramuscular injection of serum, it has not been found possible to demonstrate antitoxin in the cerebro-spinal fluid removed from the spinal theca. This argument is only valid if we assume that there is a system of channels which connect the subarachnoid space with the interior of the cord and brain. On the other hand, if no considerable anastomosis exists between the subarachnoid space and the pericellular spaces of the grey matter, and if antitoxin is able to pass from the cerebral and spinal capillaries to the nerve cells, it is matter of little importance whether it can or not pass to the fluid in the subarachnoid space.

THE AMOUNT OF ANTITOXIN IN THE CEREBRO-SPINAL FLUID AFTER THE INTRAVENOUS INJECTION OF ANTISERUM.

Cerebro-spinal fluid was obtained by lumbar puncture from five patients at various intervals after the intravenous injection of antiserum.

Observation 1.—The patient (Case 13) was given an intravenous injection of 30,000 units of antitoxin at 10 P.M. on Oct. 31st. Twelve hours later samples of blood serum and cerebro-spinal fluid were obtained. Guinea-pigs were injected as follows:—

No.	Weight in grammes.	Amount of toxin.	Amount of serum or cerebro-spinal fluid.
1	700	0·002 c.c.	1 c.c. }
2	710	0·01 ,,	1 ,, } cerebro-spinal fluid.
3	750	0·1 ,,	1 ,, }
4	680	0·01 ,,	1 ,, }
5	620	0·1 ,,	1 ,, } serum.
6	760	1·0 ,,	1 ,, }
		Control Animals.	
8	690	0·001 c.c.	3 c.c. }
9	850	0·001 ,,	2·5 ,, } normal serum.
10	800	0·001 ,,	0 saline solution.

Unfortunately one of the controls, No. 10, which received 0·001 c.c. of toxin without any antitoxin, did not die. The animal developed signs of tetanus five days after inoculation, and developed generalised spasm on the seventh day. It was very ill but ultimately recovered. No. 9 developed signs of tetanus on the third day and died of tetanus on the seventh day. No. 8 developed signs of tetanus on the fourth day and died of tetanus on the eighth day. It may be assumed that 0·001 c.c. was the smallest quantity of toxin capable of killing a guinea-pig of 700 to 800 grammes in weight. All the other animals, 1 to 6, remained perfectly well and never showed the slightest sign of tetanus. 1 c.c. of the patient's cerebro spinal fluid protected animals against twice, ten times, and 100 times the fatal dose. 1 c.c. of the patient's serum protected against 10, 100, and 1000 fatal doses.

It is evident that 12 hours after an intravenous injection of 30,000 units both the cerebro-spinal fluid and blood contained an ample quantity of the free antitoxin.

Observation 2.—Samples of blood and cerebro-spinal fluid were obtained from the patient (Case 23) 24 hours after an intravenous injection of 30,000 units. Animals were injected as follows:—

No.	Weight in grammes.	Amount of toxin.	Amount of cerebro-spinal fluid or blood serum.
1	650	0·1 c.c.	1 c.c. cerebro-spinal fluid.
2	620	0·01 ,,	1 ,, }
3	600	0·1 ,,	1 ,, } blood serum.
4	600	1·0 ,,	1 ,, }
		Controls.	
5	670	0·001 c.c.	} 1 c.c. normal saline solution.
6	650	0·002 ,,	
7	650	0·004 ,,	

No. 5 developed signs after 48 hours and generalised spasms on the fifth day. It ultimately died with well-marked signs of tetanus on the fifteenth day. No. 6 developed signs after two days and died of tetanus on the eighth day. No. 7 developed signs after 24 hours and died on the third day. The quantity of cerebro-spinal fluid obtained was only enough for one experiment. This animal (No. 1) died of tetanus on the third day. No. 2 and No. 4 remained perfectly well and developed no signs of tetanus. No. 3 never developed any sign of tetanus, but succumbed to some intercurrent disease on the fifteenth day.

This experiment as regards the cerebro-spinal fluid was not conclusive. It evidently did not contain any very large amount of antitoxin. On the other hand, 1 c.c. of the patient's serum contained enough antitoxin to neutralise from 500 to 1000 times the fatal dose for an animal of 600 grammes weight.

Observation 3.—The cerebro-spinal fluid was obtained from the patient (Case 25) 19 hours after an intravenous dose of 35,000 units.

No.	Weight in grammes.	Amount of toxin.	Amount of cerebro-spinal fluid.
1	600	0·008 c.c.	5·0 c.c.
2	600	0·004 ,,	1·0 ,,
3	590	0·004 ,,	0·5 ,,
4	590	0·008 ,,	0·5 ,,
5	560	0·02 ,,	0·5 ,,
		Controls.	
6	670	0·003 c.c.	} + Saline solution.
7	630	0·004 ,,	
8	620	0·006 ,,	
9	620	0·008 ,,	

No. 8 died with generalised spasm within 48 hours. No. 6, No. 7, and No. 9 developed signs on the second day, No. 7 and No. 9 died on the fourth day and No. 6 on the seventh day. Of the animals which had received the patient's cerebro-spinal fluid No. 5 died with generalised spasms within 48 hours. No. 4 developed signs on the second day and died on the fourth day. No. 3 developed stiffness in the limb nearest the site of inoculation. The spasm remained localised, and the animal, which was never seriously ill, recovered. No. 1 and No. 2 remained perfectly well throughout the experiment.

In this case the cerebro-spinal fluid appears to have contained a small quantity of antitoxin.

Observation 4.—The cerebro-spinal fluid was drawn off five days (Case 10) and six days (Case 9) after intravenous injections of 30,000 units.

No.	Weight in grammes.	Toxin.	Cerebro-spinal fluid.
1	740	0·002 c.c.	} + 1 c.c. (Case 9).
2	770	0·01 ,,	
3	760	0·1 ,,	
4	770	0·002 ,,	} + 1 c.c. (Case 10).
5	720	0·01 ,,	
6	760	0·1 ,,	
		Control.	
7	780	0·001 c.c.	1 c.c. saline solution.

The control animal (No. 7) developed signs on the third day and died on the ninth day. No. 3 and No. 6 developed signs within 24 hours and died within 48 hours. No. 2 died of tetanus on the fourth day. No. 5 developed signs of tetanus, was very ill, but just managed to recover. No. 1 and No. 4 never showed any signs of tetanus and remained perfectly well throughout.

In these two cases the cerebro-spinal fluid obtained five and six days after intravenous injection of 30,000 units contained small amounts of antitoxin.

The general outcome of these experiments can be summed up as follows: In one case the cerebro-spinal fluid obtained 12 hours after a large intravenous injection was shown to contain a considerable quantity of antitoxin. In four other cases in which the cerebro-spinal fluid was obtained at longer intervals after intravenous injection of antiserum, the amount of antitoxin was small. The presence or absence of antitoxin in the cerebro-spinal fluid is possibly a matter of no great importance.

THE FATE OF ANTITOXIN INJECTED INTO THE THECA.

The intrathecal method is presumably recommended on the assumption that serum introduced into the subarachnoid space is able to reach the nerve centres in the grey matter more rapidly than if it is injected into the general circulation. It is customary after lumbar injection to prop up the foot of the bed to aid in the diffusion of serum towards the upper regions of the cord and the brain.

Observation 5.—The material for this experiment was obtained from Case 2. On Oct. 2nd lumbar puncture was performed; 20 c.c. of cerebro-spinal fluid were removed and 5000 units were injected. Immediately afterwards 10,000 units were injected into the muscles. The foot of the patient's bed was propped up. Twenty-four hours after the lumbar injection a cannula was inserted between the first and second dorsal vertebræ and a sample of cerebro-spinal fluid was withdrawn. An injection of 4500 units was then given at this level. The fluid withdrawn from the upper dorsal region was injected into guinea-pigs as follows:—

No.	Weight in grammes.	Amount of toxin.	Amount of cerebro-spinal fluid.
1	330	0·05 c.c.	5 c.c.
2	330	0·05 c.c.	1 c.c.
3	350	0·0005 c.c.	0
4	350	0·001 c.c.	0

Both control animals died of tetanus: No. 3 within 48 hours and No. 4 on the fifth day. No. 1 and No. 2 showed no signs of tetanus and remained perfectly well.

It is evident that the antiserum does spread upwards within the subarachnoid space.

Observation 6.—One experiment was made with the object of determining the extent to which antitoxin is absorbed from the subarachnoid space. On Oct. 20th the patient (Case 7) was given an intrathecal injection of 5000 units. On Oct. 22nd cerebro-spinal fluid was removed by lumbar puncture (preparatory to another injection). Guinea-pigs were injected as follows:—

No.	Weight in grammes.	Amount of toxin.	Amount of cerebro-spinal fluid.
1	500	0·005 c.c.	1 c.c.
2	450	0·05 c.c.	1 c.c.
3	500	0·0005 c.c.	0

The control animal (No. 3) developed signs of tetanus after 48 hours, and died on the sixth day. No. 2 died of tetanus on the fourth day. No. 1 showed no sign of tetanus and remained quite well.

This experiment appears to indicate that much of the antitoxin had been absorbed from the fluid in the subarachnoid space.

If antitoxin injected into the theca is absorbed, as it appears to be, the question of the path by which it is absorbed becomes a matter of importance. It is probable that normal cerebro-spinal fluid is largely absorbed by the cranial sinuses and meningeal veins. It is not improbable that the greater part of the injected antitoxin follows this route, is carried into the circulation, and is removed from the central nervous system. The possibility of antitoxin passing from the subarachnoid space into the substance of the cord and brain to obtain immediate contact with the nerve cells depends on the existence of communicating channels between the subarachnoid space and the perivascular and pericellular spaces which have been described within the substance of the cord and brain. The existence of such communicating channels has not definitely been proved, and if they exist it seems probable that the flow of fluid would be from the capillary blood-vessels, through the channels, and towards the periphery of the cord and the subarachnoid space. But the antitoxin if it is to reach the nerve cells must traverse these channels in the opposite direction. In any case it is probable that the greater part of any quantity of antitoxin which might be injected would be absorbed by the cranial sinuses and meningeal veins, and that only a small part of it would find its way into the substance of the cord and brain.

In the treatment of tetanus it is obviously desirable to distribute antitoxin to every part of the central nervous system. The arteries and blood capillaries, with which every part of the grey matter is so liberally supplied, afford ideal channels for the distribution of antitoxin to every region of the brain and spinal cord. On the other hand, serum injected into the lumbar region will in time pass up in the subarachnoid space and may filter through to the cells of the cervical cord, medulla, and brain. It is precisely these centres in the cervical cord and in the medulla oblongata which it is most necessary to protect from the tetanus toxin. It is difficult to believe that serum injected into the lumbar theca reaches the cells in the medulla more quickly than serum which is injected into a vein. Moreover, the endothelium of capillary blood-vessels freely permits the passage of an albuminous fluid, the lymph, which bathes the cells of the body, while the cerebro-spinal fluid, the secretion of an epithelium which holds back almost completely the proteins of the blood, is not, under normal circumstances, concerned in the distribution of albuminous substances, and it is difficult to see why it should be chosen as a medium for the introduction of antitoxin to the tissues of the central nervous system. The natural channel for the distribution of an albuminous substance like antitoxin would seem to be arteries and capillary blood-vessels.

ANAPHYLAXIS.

Concerning anaphylaxis, much has been written and little is known. Such information as we possess has been derived for the most part from experiments on laboratory animals. It has been ascertained that different species of animals differ widely from one another both in their susceptibility to anaphylaxis and the symptoms which they exhibit during the attack. Interesting and valuable as many of these observations are, they do not as yet provide all the data required for the elucidation of the problem of anaphylaxis as it occurs in man. The symptoms observed in anaphylaxis fall chiefly into two groups: (1) those associated with anaphylactic shock; (2) various minor symptoms. The conditions under which anaphylactic shock may occur are manifestly of predominant importance, for the minor symptoms of anaphylaxis, although unpleasant, are not associated with danger to life.

It has been established in the case of animals that the second dose, if it is desired to produce shock, should be given by intravenous or intracerebral injection. In the case of an antigen, which is in itself comparatively non-toxic (e.g., the serum of an animal of different species), it is difficult to produce anaphylactic shock if the second dose is injected into the muscles or beneath the skin. All, however, who have carried out experiments on anaphylaxis are aware that animals differ enormously in their individual susceptibility, and even under laboratory conditions the peculiarities of individual animals render attempts at generalisation very difficult. Even under the most favourable conditions a certain proportion of a batch of animals fail to exhibit shock even if a suitable dose has been injected into a vein. One of the most interesting, and for our immediate purpose valuable, of the results obtained in the laboratory is the observation that acute anaphylactic death does not occur if the animal at the time of the second inoculation is under the influence of an anæsthetic.

Of the 25 patients 14 were given large intravenous doses of serum.

One patient (Case 17) died while still under the anæsthetic, shortly after the serum had been injected. There was no reason to think that death was due to anaphylaxis.

In one case only (No. 18) of the remaining 13 did shock occur. The signs of shock made their appearance after the patient had recovered consciousness. The skin was pale and cold, the pulse small and rapid, the respirations shallow. The shock was accompanied by urticaria and œdema of the eyelids.

An urticaria followed within a few minutes of the intravenous injection in four other cases and was unaccompanied by any sign of shock. The urticaria covered the whole body. It was first noted on the face or backs of the hand. In several cases when the clothing was opened to look for the rash no urticaria was seen until the part had been exposed for some seconds—that is to say, the rash appeared to spread in turn to each part of the body as it was uncovered. The urticaria had usually disappeared at the end of half an hour.

The œdema of eyelids which was noted for the first time in Case 17 was seen in one other case (No. 18), on which occasion there was no sign of shock, and the pulse, respiration, and general condition were excellent throughout and after the injection. The œdema was perfectly definite and was more obvious in the upper lid, the appearances resembling those seen in renal disease.

Quite recently I have had the opportunity of observing in one other case symptoms possibly due to anaphylaxis.

About 50 c.c. of serum had been given, when, as it was noticed that the needle had slipped out of the vein, the injection was interrupted. It was found necessary to re-sterilise a piece of rubber-tubing, and before this had been done the respirations were observed to be shallow and intermittent. The patient had partly come round from the anæsthetic. Respiratory movements ceased for a few minutes, and the pulse became small and rapid. Respiratory movements were resumed after a period of artificial respiration. Slight urticaria and œdema of the eyelids were observed in this case. An intramuscular injection of 6000 units had been given earlier in the day. In the case already described (No. 18) in which shock was observed an intramuscular injection of 6000 units, probably about 25 c.c. of serum, had been given about six hours before the intravenous injection.

Table II. shows the intervals which elapsed in each case between the last subcutaneous or intramuscular dose of serum and the intravenous injection.

In 5 cases no serum was given between the prophylactic dose in France and the intravenous injection. Of these 5 cases, 1 showed an urticaria after the intravenous injection. In the other 8 cases intramuscular or subcutaneous doses of serum had been given as treatment before the intravenous injection. Of these 8 cases, shock, urticaria, and œdema of eyelids were observed in 1, urticaria and œdema of eyelids in 1, and urticaria in 2. In Case 20, for example, 2000 units had been injected on the same day as the intravenous injection and on each of the four preceding days. Nevertheless, the intravenous injection was followed by urticaria and œdema of the eyelids.

There seems no reason, from this series of cases, to suppose that preliminary doses of serum are likely to prevent the occurrence of anaphylactic phenomena. It is well known to laboratory workers that rabbits during the process of immunisation against an alien serum, in which the inoculations are given at three-day intervals, often show anaphylactic symptoms.

It must be admitted that 14 is not a very large number of cases from which to generalise, but the results obtained seem to show that no very great risk attaches to the intravenous injection of serum under deep chloroform anæsthesia. On the other hand, the results obtained as regards treatment were good. An urticarial rash, accompanied in some cases by other symptoms of "serum sickness," occurred in nearly all the cases on the fifth day after the intravenous injection. In several cases an increase of the tetanic spasm was observed during the period of the rash, and the impression was often produced that the tetanus was worse. The exacerbation of symptoms came to an end on the following day in every case. This rather interesting phenomenon was possibly due to the increased irritation and stimulation of afferent nerves as a result of the serum sickness.

AMOUNT OF SERUM REQUIRED FOR TREATMENT AND QUESTION OF REPEATED DOSES.

It is very generally held that injections of serum should be given at frequent intervals until every sign of tetanus has disappeared. It is, however, obvious that there is no need to give a second dose while there is still a large amount of free antitoxin in the circulation. The condition of the patient gives us no information on this point.

The appearance of definite signs of tetanus is evidence that the toxin has got a long start, and a large dose of antitoxin should immediately be given. A large dose is needed for the rapid neutralisation of free toxin, and if it is possible to dissociate toxin which has already reached the nerve cells the larger the dose the better. The effect of a suitable dose is to arrest the progress of symptoms. The antitoxin exerts no curative effect on the nerve cells which have been damaged. The possibility of further damage is averted and an interval must elapse before the damaged elements of the central nervous system recover. In this series of cases after the injection of 30,000 units there was, as a rule, no definite improvement until the fourth and sometimes until the seventh day. In one or two cases the signs were slightly more marked during the ensuing 48 hours. Nevertheless, there was probably plenty of free antitoxin in the blood stream during the week which followed the intravenous injection. With the object of obtaining definite information several experiments were carried out.

Observation 7.—The patient (Case 4) had a subcutaneous dose of 1500 units on Oct. 13th and on Oct. 14th 30,000 units were injected into a vein. This man had no subsequent injections. On Oct. 20th a specimen of blood was obtained and the following experiment was carried out with the patient's serum:—

No.	Weight of guinea pig in grammes.	Amount of toxin.	Amount of patient's serum.
1	500	0·005 c.c.	1 c.c.
2	500	0·05 ,,	1 ,,
3	500	0·0005 ,,	0

The control animal No. 3 developed signs on the third day, and died of tetanus on the sixth day. No. 1 and No. 2 remained perfectly well and never developed any signs of tetanus.

Another specimen of the patient's serum was obtained on Oct. 31st, 17 days after the intravenous injection. On the same day blood was taken from another patient (Case 11) on the eighth day after the intravenous injection.

No.	Weight of guinea-pig in grammes.	Amount of toxin.	Amount of serum.
1	780	0·01 c.c.	1 c.c. (Case 4).
2	750	0·01 ,,	1 ,,
3	750	0·1 ,,	1 ,, (Case 11).
4	750	1·0 ,,	1 ,,
		Controls.	
5	690	0·001 c.c.	3 c.c. Normal serum.
6	850	0·001 ,,	2·5 ,, ,, ,,
7	800	0·001 ,,	0

Of the controls, No. 7 developed signs of tetanus on the sixth day, was very ill, but eventually recovered. No. 5 developed signs on the fourth day and died on the eighth day. No. 6 developed signs of tetanus on the third day and died on the seventh day. Nos. 1, 2, 3, and 4 never showed any signs of tetanus and remained well.

Observation 8.—The sera for this experiment were obtained from Cases 15 and 18. In the one case (15) the patient was given an intravenous injection of 30,000 units on Nov. 10th. The patient had no other injection of serum, and a sample of blood was taken 39 days later, on Dec. 19th. The second patient was given an intramuscular injection of 6000 units and an intravenous injection of 30,000 units on Dec. 3rd and an intramuscular injection of 5000 units on Dec. 7th. Blood was taken on Dec. 19th.

No.	Weight of guinea-pig in grammes.	Amount of toxin.	Amount of serum.
1	650	0·01 c.c.	
2	650	0·1 ,,	+ 1 c.c. (Case 15).
3	650	1·0 ,,	
4	650	0·01 ,,	
5	620	0·1 ,,	+ 1 ,, (Case 18).
6	650	1·0 ,,	
7	670	0·001 ,,	
8	650	0·002 ,,	+ 0
9	650	0·004 ,,	

Of the controls, No. 9 showed signs after 24 hours, and died of tetanus on the third day. No. 7 and No. 8 developed signs on the second day. No. 8 died of tetanus on the eighth day and No. 7 on the fifteenth day. Of the animals inoculated with serum from Case 15, No. 3 had generalised spasms within 24 and died within 48 hours. No. 2 showed signs of tetanus on the eighth day, but had recovered by the twelfth day. No. 1 showed no signs of tetanus. Nos. 4, 5, and 6 never showed any signs of tetanus.

Observation 9.—Experiments on exactly the same lines were carried out in connexion with Cases 20, 23, 24, and 25.

No of case.	Interval between intravenous injection and collection of blood	Amount of toxin neutralised by 1 c.c. of patient's serum.	Amount of toxin fatal to guinea-pigs of same weight.
20	30 days.	0·04 c.c.	0·003 c.c.
23	25 ,,	0·4 ,,	
24	20 ,,	0·02 c.c.	0·0005 c.c.
25	19 ,,	0·02 ,,	

None of these patients had any more serum after the intravenous injection. The animal injected with 0·4 c.c. toxin and 1 c.c. of serum from Case 20 developed no sign of tetanus, but unfortunately died on the fourth day after inoculation.

The results obtained from the above experiments show that 20, 30, and even 39 days after a single intravenous injection of 30,000 units the blood of the patient may contain appreciable quantities of antitoxin. It is possible that some of the antitoxin, the presence of which was

demonstrated, was not the antitoxin originally injected but was antitoxin manufactured by the patient. This possibility need not, however, be discussed, as the object of the experiments was to obtain evidence as to the necessity of giving repeated doses of serum. The evidence provided by the clinical histories confirms the experimental results. Of the 13 patients, seven received no further serum treatment after the intravenous injection, while the other six were given one or more additional doses of serum by intramuscular or subcutaneous injection. If the histories of the patients in these two groups are compared, no difference in the rapidity of the disappearance of symptoms is apparent.

These 13 cases afford no evidence in favour of frequent injections of serum.

THE EMPLOYMENT OF HYPNOTIC AND SEDATIVE DRUGS.

The drugs employed in the treatment of these 25 patients were morphia, potassium or sodium bromide, and chloral hydrate. The extent to which hypnotic drugs were employed varied enormously in the different cases.

One patient appears to have consumed during seven days about 10 drachms of potassium bromide and 10 drachms of chloral hydrate. At the end of this period the patient was in a sleepy and comatose condition and the pulse was small, rapid (130), and irregular. Nevertheless, in spite of the very considerable quantity of drugs which had been given, there was well-marked spasm of the jaw, neck, abdomen, and thigh.

On the other hand, in several cases the number of doses of hypnotics given was very small, and in a few no hypnotics were given at all. The majority of the patients to whom but few doses of hypnotic drugs were given made good recoveries and their general condition was far more satisfactory than that of those who had received frequent doses of drugs.

Tetanus toxin is a very efficient poison to the central nervous system and drugs such as chloral and morphia, which are also essentially poisons to the nervous system, should, in the opinion of the writer, be used with considerable caution.

The use of hypnotic drugs in the treatment of tetanus should probably be restricted to the minimum necessary to relieve violent pain and secure necessary sleep. The amount of hypnotic drugs which is absolutely essential must be ascertained by direct trial for each patient. In those cases in which pain can be moderated and sleep secured by relatively small doses, it is unnecessary and probably injurious to give larger amounts. In tetanus, as in other toxic conditions, the less morphia and chloral are given the better are the patient's chances of recovery.

SUMMARY AND CONCLUSIONS.

1. All the 25 patients had had suppurating wounds, but in the majority of cases the wounds were not more serious, and the suppuration had not been more considerable than in the average case sent home to a hospital in England. In 4 cases the wounds were of a comparatively trivial nature. In 9 cases the wounds at the time of the onset of tetanus had completely or almost completely healed. If every wounded soldier, irrespective of the size or condition of the wound, was given a prophylactic injection on his arrival in this country, there would in all probability be a still further reduction in the number and severity of cases of tetanus.

2. Compound fractures are a particular source of danger, and were present in 11 of 25 cases of tetanus.

3. In 3 of the 25 cases the disease ran an extremely short and mild course. These were the only three patients who had received a prophylactic injection after their arrival in England.

4. One result of prophylactic injection is to prolong enormously the incubation period, with the result that tetanus may occur after the wounds have completely healed, and the patient has been transferred to a convalescent hospital. Under these circumstances the earliest signs are readily overlooked.

5. The pain associated with the early and local symptoms may lead to a diagnosis of rheumatism or muscular rheumatism.

6. The earliest signs may consist of clonic or tonic contraction of muscles in the immediate neighbourhood of a wound, usually in the nearest flexor group. The signs may remain localised for many days, and it is characteristic of some cases occurring in inoculated patients that the period of onset is enormously prolonged.

7. After a longer or shorter interval generalisation occurs. The muscles of the jaw, neck, and abdomen become stiff. There is profuse perspiration and the reflexes of the lower limbs are exaggerated. In many cases the pulse-rate may be very rapid and the temperature normal. On the other hand, even in inoculated persons and after a very long incubation period, the disease may begin suddenly with spasm of the muscles of the jaw and neck.

8. Of 5 mild cases treated by intramuscular and subcutaneous injections of serum 5 recovered. Of 14 cases treated chiefly by intravenous injections 13 recovered. Of 5 cases treated by intrathecal with or without other injections 3 recovered. One patient who was given an intravenous and subsequently an intrathecal injection died. If the signs are well localised and are not spreading rapidly intramuscular injections afford an adequate method of treatment. In severe cases, and in those in which signs are generalised, an intravenous injection (30,000 units) under deep chloroform anæsthesia should be given. After such injection the further progress of the disease is usually arrested, and definite improvement may be expected two to seven days later.

9. There is reason to think that the danger of intravenous injection has been exaggerated. The essential principle of serum treatment is to give a very large dose of antitoxin at the earliest possible moment. This object can be most easily attained by the intravenous route.

10. In 4 cases serum treatment was confined to a single intravenous dose of 30,000 units. In 3 other cases no serum was given subsequent to the intravenous injection. In these 7 cases recovery was as rapid as in 6 other cases in which subsequent injections were given. The serum of patients was shown to contain free antitoxin at various intervals up to 39 days after an intravenous injection of 30,000 units.

In conclusion, I desire to express my thanks to Captain Telford who has kindly given me permission to include one of his cases in this series. To Dr. MacConkey, who supplied the tetanus toxin which was used in the experimental portion of the work, my best thanks are due. I also wish to express my thanks to Major Turner, Captain Morley, Captain Walker, and other medical officers in charge of military and auxiliary hospitals who have helped me by supplying material and information which have been of the greatest service in the preparation of this report.

THE INTRAMUSCULAR *VERSUS* THE INTRATHECAL ROUTE IN THE TREATMENT OF TETANUS BY THE INJECTION OF ANTITOXIN.

BY SIR DAVID BRUCE, C.B., M.B., C.M. EDIN., F.R.C.P. LOND., F.R.S.,

SURGEON-GENERAL, ARMY MEDICAL SERVICE; CHAIRMAN, WAR OFFICE COMMITTEE FOR THE STUDY OF TETANUS.

THE Tetanus Committee has been labouring for a long time trying to impress Army medical officers with the importance of the recognition of the earliest symptoms of tetanus and that time is the all-important element in serum treatment. A delay of an hour may make all the difference between success and failure. It is, therefore, obvious that it is necessary to give antitoxin by the method which enables it to produce its effect with the least delay.

In THE LANCET of Jan. 27th, 1917, a paper appeared, entitled "An Analysis of Recent Cases of Tetanus in the British Expeditionary Force," by Colonel Sir William B. Leishman, A.M.S., and Major A. B. Smallman, R.A.M.C. In this paper it is laid down that the best and most effective route for the injection of antitetanic serum is the intramuscular. As chairman of the Tetanus Committee I have been deputed by the members to question this statement.

In the Memorandum on Tetanus published in November, 1916,[1] the Committee stated that "experimental and clinical evidence has shown that the best results are obtained by intrathecal injections of serum"; and, again, "in a case of tetanus the first thing to do is to give an intrathecal injection of antitoxin." Sir William Leishman and Major Smallman, on the other hand, as the result of the study of their figures, write: "They appear to us to throw very considerable doubt upon the advisability of employing the intrathecal route, either alone or in combination; and, further, they seem to indicate considerable virtues in connexion with the

[1] THE LANCET, Nov. 18th, 1916, p. 873.

employment of the subcutaneous and intramuscular channels, particularly the latter." Also, "We find our suspicions of the thecal and venous routes strengthened, and also some further support for the good impression which has been made on us by a consideration of the results of the subcutaneous and intramuscular routes." In regard to the intrathecal route they consider "that the evidence is pretty strongly against its employment." In conclusion, they place the alternative routes in the following order of merit: intramuscular, subcutaneous, intrathecal, and intravenous.

The difference of opinion on this important point between the Committee and Sir William Leishman and his colleague is therefore plain and manifest. This statement by Sir William Leishman and Major Smallman is even now having a marked effect in the treatment of tetanus in England. Already letters have been received from inspectors of tetanus saying that it will be difficult, if not impossible, in future to get intrathecal injections carried out promptly. It is so much easier to give an intramuscular injection. "Facilis est descensus." Given the choice between the straight and narrow intrathecal route and the broad and easy intramuscular, it is not to be wondered at if the majority choose the latter.

In this paper it is proposed to confine the issue strictly to the thesis, intramuscular *versus* intrathecal injections. It is doubtful if any truth can be arrived at by the study of the figures at our disposal relating to the result of injections of antitoxin in the human subject. There is no uniformity in the treatment of tetanus in man. The men who suffer are also, as a rule, suffering from other grievous maladies—wounds, fractures, septicæmias, pneumonias, heart failure, &c., so that if the man dies it is impossible in many cases properly to assign the cause. But when we take experimental animals to which a constant dose of the poison can be given and in which the effect of the antitoxin can be carefully watched, we are in a much better position to adjudicate on a simple question such as the merits of the two methods of injection. An ounce of experimental fact is worth a ton of speculation. The only argument brought forward, then, will be one based on animal experiment. This, it is hoped, will be considered legitimate, although there is a great difference between tetanus in man and in an experimental monkey. In the former there are living tetanus bacilli, in the latter a weighed quantity of the dead poison. But the question asked in this paper is a restricted one, "Which is the better route—the intrathecal or the intramuscular?" and in trying to arrive at the correct answer an argument taken from animal experiment seems not only to be a fit and proper one, but the only sure one available. The animal used in this experiment is the monkey, and the experimenter is Professor C. S. Sherrington, a member of the Tetanus Committee. The following is a description of the experiment in his own words:—

Some experiments recently conducted at the request of the Committee upon monkeys bear on the relative efficacy of the serum treatment by intramuscular and intrathecal injection respectively. The experiments exhibit the effect of a single injection of antitetanic serum upon a single precurrent dose of tetanus toxin. They show a difference between the results obtained by the intramuscular and intrathecal methods respectively. The contrast seems sufficiently marked to be significant, although the experiments are at present few in number.

For the experiments the same sample of toxin was used throughout. It was kindly provided by Dr. A. T. MacConkey, of the Lister Institute. The minimal lethal dose of it for the monkey was not ascertained; but in eight control experiments carrying the dose down to 0·8 mgm. per kilo. monkey it proved lethal in all, none of the animals surviving the inoculation longer than 5½ days, and all dying of generalised tetanus. These observations have now been carried down to 0·5 mgm., which likewise killed the animal, but less quickly.

The mode of giving the toxin was the same in most of the cases: the weighed dose was inserted as the dried powder into a small cross-cut about 8 mm. long and 4 deep cut in the outer head of the left gastrocnemius muscle; the lips of the muscle wound were then drawn together by a single fine suture and the skin wound closed by stitches. This inoculation and the subsequent injection of antitetanic serum were made under full anæsthesia and with full aseptic precautions. Some of the later experiments have been made with the toxin in solution.

The antitetanus serum used was likewise kindly provided by Dr. MacConkey and its values in U.S.A. units were supplied by him. It was of various degrees of strength in units per c.cm. In comparative pairs of experiments the sample concentration used was the same.

For the *intramuscular* injections the serum was given in the usual way—under light chloroform anæsthesia; the shaved skin was cleansed and swabbed with iodine; the site chosen was the muscles one-third down the back of the thigh of the limb which had received the toxin. When, as was often the case, the quantity of serum injected was large, part of the dose was given into the muscles at the back of the neck. No local inconvenience resulted to the animal from these injections.

For *intrathecal* injection the animal was anæsthetised, the skin of the top of the back of the neck shaved, cleansed, and swabbed with iodine, and then the atlo-occipital membrane was exposed by suitable incision. Some of the cerebro-spinal fluid was then withdrawn with the syringe needle thrust through the membrane, and without withdrawing the needle the antitetanus serum was then injected. It was usually not possible to introduce more than 3 c.cm. of serum. The needle was then withdrawn and the wound closed with deep and superficial stitches under full asepsis.

A factor of high importance as influencing the success of the serum treatment is length of time elapsing between the giving of the serum and the giving of the toxin; the shorter this interval the more favourable the opportunity for the serum to have effect. This factor and the amount of the dosage of the toxin and serum are exhibited in the accompanying table.

TETANUS TOXIN EXPERIMENTS.

Intramuscular and Intrathecal Injections of Antitetanic Serum Compared.

Monkey's expt. cage number.	Dose of toxin in mgm. per kilo. of monkey.	No. of hours from inoculation of—		Dose of serum in units per kilo. monkey.	Result.
		Toxin to first symptoms	Toxin to giving serum.		
		Intramuscular.			
XXXII.	3·5	29	66	2320	Death in 5½ days.
VII.	2·4	30	66	1360	,, 6¼ ,,
XXXV.	2·0	30	54	1200	,, 10¼ ,,
LXXV.	2·0	30	50	1600	,, 7½ ,,
LXXVII.	2·0	30	74	2100	,, 5½ ,,
XXXIII.	1·8	30	69	1480	,, 5¼ ,,
XXIV.	1·7	30	68	2518	,, 11½ ,,
XLI.	1·6	30	50	2083	,, 5½ ,,
IV.	1·6	30	72	850	,, 4¼ ,,
XXXVI.	1·5	30	54	1300	,, 12¼ ,,
XL.	1·3	30	74	1365	,, 5¼ ,,
XXXVII.	1·1	30	93	1250	,, 9½ ,,
		Intrathecal.			
XVII.	4·4	28	78	1407	Death in 5½ ,,
XIX.	4·3	28	78	1956	,, 8¼ ,,
XI.	3·5	29	69	1000	Recovery.
XII.	2·7	30	78	910	Recovery.
IX.	2·7	30	69	300	Death in 4½ days.
XX.	2·2	30	71	1478	Recovery.
XXIII.	2·1	30	68	1085	Recovery.
LI.	2·0	28	51	1500	Recovery.
L.	2·0	28	51	1630	Recovery.
XXVI.	2·0	30	54	560	Recovery.
XLVII.	2·0	30	51	1000	Recovery.
LXXVIII.	2·0	30	72	1600	Recovery.
LXV.	2·0	30	78	2250	Death in 5½ days.
LVI.	2·0	34	68	1800	Recovery.
XXVIII.	1·9	30	54	711	Recovery.
III.	1·8	30	72	966	Recovery.
XXXIX.	1·3	30	74	1200	Recovery.
XXIX.	1·1	30	93	571	Death in 11½ days.

It will be seen from the table that the results are distinctly in favour of the efficacy of the intrathecal as against the intramuscular method.

For instance, with a toxin dose of 3·5 mgm. per kilo. monkey, serum in a dosage of 2320 units per kilo. animal, given intramuscularly 66 hours after the toxin, hardly appreciably prolonged life; whereas by the intrathecal method the serum in a dosage of 1000 units per kilo. animal, given 69 hours after the toxin, was followed by recovery.

Again, with a toxin dose of 2·4 mgm. per kilo. animal, serum in a dosage of 1360 units per kilo. animal given intramuscularly 66 hours after the toxin, was followed by death from generalised tetanus in 6¼ days; whereas with toxin 2·7 mgm. per kilo. animal, serum in a dosage of 910 units per kilo., given intrathecally 78 hours after the toxin, was followed by recovery.

Again, with a toxin dose of 2 mgm. per kilo. animal, serum in a dosage of 1200 units per kilo. animal, given intramuscularly 54 hours after the toxin, was followed by death from generalised tetanus in 10¼ days; whereas with the same dose of toxin, serum given intrathecally at the same period after the toxin, in dosage of 560 units, was followed by recovery.

Again, with 1·3 mgm. toxin per kilo. animal, serum in the dosage of 1365 units per kilo., given 74 hours after inoculation intramuscularly did not obviously retard the fatal result. But with the same dosage of toxin, serum given intrathecally

after a similar lapse of time from the toxin inoculation and in somewhat smaller dosage (1200 units per kilo.), was followed by recovery.

Of the group of 12 animals treated intramuscularly none recovered. Of the group of 18 animals treated intrathecally 13 recovered. But the contrast is more marked than that simple comparison might suggest. Reference to the table shows that in the case of one (IX.) of the intrathecal experiments the dose of serum given was much smaller than was tried in any of the intramuscular experiments. In another case (XXIX.) it was less than half the amount given in the experiment (XXXVII.) most comparable with it in the intramuscular group. Further, the doses of toxin given in two other animals which died in the intrathecal group were larger than any of the toxin doses administered under the intramuscular group.

Can any unbiassed person examine Professor Sherrington's results and not be struck at the manifest superiority of the intrathecal over the intramuscular route? In the cases treated intramuscularly the disease was hardly retarded in its fatal result, whereas almost all those treated by the intrathecal route recovered; the few that died had either too much toxin or too little serum given. The proof of the pudding is in the eating of it. Here is no *in vitro* experiment, but definite living animals all stricken by a mortal malady. Treated intramuscularly they all die. Treated intrathecally the great majority live.

ON THE INTRATHECAL ROUTE FOR THE ADMINISTRATION OF TETANUS ANTITOXIN.

BY F. W. ANDREWES, M.D.OXON., F.R.C.P.LOND., F.R.S.,
MAJOR, R.A.M.C.T.; MEMBER OF THE WAR OFFICE COMMITTEE FOR THE STUDY OF TETANUS.

With a Note on a Case of Tetanus Successfully Treated. By F. W. ANDREWES *and* THOMAS J. HORDER, M.D. Lond., F.R.C.P. Lond.

THERE are six routes by which tetanus antitoxin may be given in curative treatment. Of these the intracerebral and intraneural routes are unsuited for regular use, and are, by common consent, reserved for special and desperate cases. The other four routes are the subcutaneous, intramuscular, intravenous, and intrathecal; at the present time opinions are still widely divided as to the relative advantages of these. While I am personally an advocate of the intrathecal route, I recognise that there are other observers with an equal right to judge who prefer one or other of the alternative routes. My purpose in this paper is to record my own experience of the intrathecal route, and to set forth, as far as I am able, the reasons which weigh with me in my preference.

It is of interest to analyse the influences which are at work in determining individual judgment on such a matter. The most powerful influence is, I imagine, personal experience; the man who has the misfortune to lose one or two cases early in his trials of a given route naturally conceives a prejudice against it, while with another, who happens to meet with success, the reverse is the case. Failure, no less than success, is apt to occur whatever be the route chosen, and thus chance comes to play some part in one's preference. The military cases of tetanus which are now occurring in this country are not very numerous, for the prophylactic injection of antitoxin has largely controlled the disease, and most of the cases which occur in spite of the injection are greatly modified in their severity, many being cases of local tetanus only. It is probable that a large proportion of these milder cases would recover whatever the route of administration of the serum, or even without serum at all. It thus comes about that the advocate of any route is able to bring forward lists of cases with a large percentage of recoveries, so that it has become more difficult than before to appraise the relative values of the different routes.

Conclusions derived from Statistical and Physiological Data.

A common method by which attempts have been made to reach a decision is the statistical one. If we had sufficiently large series of comparable cases treated each with comparable doses of serum by the four different routes separately it might be easy to draw conclusions from the relative case-mortalities of each series. But such data are not forthcoming, and we shall probably never get them, for the primary object is always the cure of the patient. As a rule, more than one route is employed in any given case, and the widest discrepancies exist not only as to choice of route but as to dosage of serum, while different cases of tetanus present extreme variations in severity. It does not seem legitimate to draw any conclusions from the heterogeneous mass of data at present available. In his analysis of the cases of tetanus occurring in this country during the first year of the war, Surgeon-General Sir David Bruce found that the mortality was a little lower in those who had received intrathecal injections of serum than in those who had not; but when he came to apply a similar analysis to the cases occurring in the second year of the war this advantage was no longer seen. Last January Colonel Sir W. B. Leishman and Major A. B. Smallman published an elaborate and exhaustive analysis of 160 cases occurring amongst our troops in France during last summer and autumn[1]; their figures brought out the surprising result that the highest mortality was amongst the cases which had received an intravenous injection, while the intrathecal route was not much better; the best apparent results were achieved by the subcutaneous and especially by the intramuscular routes. They state that they are fully aware of the many pitfalls incident to the search for truth amongst small figures dealing with cases presenting many complicating factors, and perhaps the most serious of these are the facts that no less than 61 out of their 113 fatal cases had gas-gangrene, and that cases are included as fatal cases of tetanus whether they died of tetanus or of some complication. Thus of 21 fatal cases treated by intrathecal injection only, 9 were attributed by the reporting officer to causes other than tetanus. There is a natural tendency to employ the more heroic measures of intravenous and intrathecal injection in the more desperate cases and to be content with the simpler procedures in slighter cases; I have certainly been influenced by this tendency myself. Taking into consideration all these sources of fallacy, I cannot but feel that argument from such confused statistical data is a somewhat hazardous proceeding.

There is a third method of justifying a preference for a certain route which is also hazardous. This consists in *a priori* reasoning from supposed physiological data. It is, for example, common to hear it said that the intrathecal route must be the best because thus the antitoxin is brought into the closest relation with the central nervous system; while others, again, defend the intravenous route because the antitoxin is thus carried into the closest attainable contact with the affected motor neurons. The fallacy of such reasoning lies in the fact that it rests on insecure physiological premisses. There is no actual proof that antitoxin can pass from the cerebro-spinal fluid into the substance of the central nervous system, nor any proof that it can reach the neurons from the capillaries adjacent to them. There is no proof that, if these things were true, the antitoxin could dissociate from the neurons the toxin which had already entered into combination with them. Many physiologists hold opinions on these points and arguments can be arrayed on either side, but we have not sufficient proof, or even consensus of opinion, to enable us to reason safely on such a difficult subject as this.

The Method of Experiment.

There remains one method which has been helpful in deciding many vexed questions: it is that of experiment, and I must confess that I place more reliance on this than on any other method in deciding on a choice of route. Though we cannot get "clean data" from human cases of tetanus they can be obtained by animal experiment. It is possible to introduce known and similar doses of tetanus toxin into series of animals, allow the disease to commence, and then determine the route by which equal suitable doses of antitoxin are most successful in saving or prolonging life. More than one series of experiments has been carried out on these lines. In Denmark Permin showed that when tetanus toxin was injected into the muscles in suitable dose local tetanus was prevented when antitoxin was given intrathecally at the same time, whereas it was not prevented by the same dose of antitoxin given intravenously; not even intrathecal injection prevented tetanus if it was given four hours after the toxin. Permin

[1] THE LANCET, 1917, i., 131.

used dogs and rabbits in these experiments. More often quoted is the work of Park and Nicoll on guinea-pigs. These observers injected into the muscles of the hind leg two minimal lethal doses of toxin, waited till spasm of the leg commenced, and then tried antitoxin by various routes. In one experiment on 18 guinea-pigs the 2 controls without antitoxin died in three days; 6 received 100 and 200 units of antitoxin by the intracardiac route, and 4 received 200 units by the intraneural route; all these 10 animals died in from three to eight days. The remaining 6 received intrathecal doses, 3 getting only 10 units and 3 50 units; 5 out of these 6 animals recovered. This is only one out of four experiments they record, but in all the same marked superiority of the intrathecal route was manifest. It has been objected to these experiments that it is impossible to give an intrathecal injection in such small animals without wounding the cord, and it is probable that they did sometimes wound it, as they state that transitory paralyses of the hind legs followed the injections in a few cases. But whether or not these were pure intrathecal injections the animals nearly all recovered from two minimal lethal doses of toxin, whereas nearly all those treated by other routes perished, and this although the intrathecal doses of antitoxin were much smaller than those given by the other routes. Captain Golla has done similar experiments on cats and rabbits. He finds the intrathecal and intravenous routes greatly superior to the subcutaneous in saving life.

Quite recently Professor C. S. Sherrington has carried out for the War Office Committee for the Study of Tetanus a series of experiments on monkeys on similar lines to the above, and these he is now publishing. He permits me to state that when symptoms of tetanus have commenced the intravenous and intrathecal routes for administering antitoxin have proved vastly superior in prolonging or saving life to the intramuscular route, the intrathecal being slightly superior to the intravenous. It may thus fairly be said that in experimental work where the dosage of toxin and antitoxin can be accurately controlled and the experiments rendered strictly comparable the available evidence indicates the intrathecal route as the most effective in saving life in animals in the early stages of tetanus. I think that great weight must be attached to such evidence, and it seems to me that we should be justified in refusing to employ the intrathecal route in suitable human cases, only if it could be shown that grave risk attaches to the method; this with reasonable care I believe not to be the case. I will refer later to another argument relating to the risk of anaphylactic shock.

Results of Intrathecal Injections.

Such are my reasons for preferring the intrathecal route, and I will now state shortly the results which I have seen from its use during the past six months. Since the middle of September, 1916, I have acted as tetanus inspector for the military hospitals in the London District north of the Thames. It has been my duty to see at once every case or suspected case of the disease, to take notes, and to confer with the medical officer in charge of the case as to treatment. In six months I have been summoned to 24 cases. One of these was clearly not tetanus, and 3 were convalescent cases which had received their treatment in France. Twenty cases were, in my judgment, tetanus, or sufficiently like it to be treated as such, though in one or two instances of such extremely mild type as to be somewhat doubtful. Many of the cases I saw but once in consultation, though in all I kept in touch with the responsible medical officer till the upshot of the case was clear. Some of the cases had already been receiving serum treatment before I was sent for, but in most I felt it my duty to urge the administration of large doses of antitoxin by the intrathecal route, and this was usually done. Sixteen out of the 20 received intrathecal treatment. One case received no serum treatment at all. The cases have presented every gradation from the most acute general tetanus to the mildest local form of the disease. I will endeavour to group them more or less in the order of their severity.

Cases of Acute General Tetanus.

CASE 1.—Severe burns of face, neck, back, and limbs. Patient had rolled in mud to extinguish flames. No prophylactic dose of antitoxin. Incubation 10 days. Onset with trismus and difficulty in swallowing. Serum treatment not commenced till third day, when 16,000 U.S.A. units were given intrathecally and 8000 units intramuscularly. These doses were repeated on the following day, but the patient died in violent opisthotonic spasms on the night of the fourth day.

CASE 2.—Appendicectomy. No antitoxin given. Incubation nine days. Onset with trismus, stiff neck, and twitching of abdominal muscles. Serum treatment begun on second day—12,000 units intravenous and 12,000 intramuscular. These doses were repeated on the following day, after which only subcutaneous doses were given. Patient held his own for four days and then died from heart failure rather than from any violent muscular symptoms. *B. tetani* was recovered from the wound and from a snipping of the appendix stump after death.

CASE 3.—Gunshot wound of loins; flesh wound only. 1500 units antitoxin on following day. Incubation 10 days. Onset with fever, frequent pulse, and delirium. Jaws and neck stiff; back and shoulder muscles quivering, but no opisthotonic spasms. Received 8000 units of antitoxin intrathecally and 1000 into muscles of back on day of onset, and 27,000 units intrathecally on the following day. Nevertheless, he died about 48 hours from onset, not from manifest tetanus, but from profound toxæmia.

CASE 4.—Gunshot wound of right femur, followed by gas gangrene. Presumably had had antitoxin. Patient's general condition became bad, and the condition of the leg was such that amputation was performed two and a half months after the injury. Previous to this operation the patient had at times complained of transient stiffness of the jaw and neck. Incubation 85 days from wound, six days from amputation. The earliest symptoms were trismus and stiff neck, and these lasted four days before tetanus was definitely diagnosed. The patient then had a convulsive seizure and died a few hours later while preparations were being made to give antitoxin. Apart from the tetanus, his general condition was so bad as to give little hope of his recovery.

CASE 5.—Shrapnel wound of loins, not involving bone. Patient not aware that he had had antitoxin. Wound dirty at first, then granulated healthily. Incubation 14 days. Onset with feeling of constriction round waist and rising temperature. On the third day slight trismus, difficulty in swallowing solids, and stiff neck. On the fourth day marked trismus and opisthotonic spasms, with sweating. Serum treatment commenced on fourth day—1000 units subcutaneously in the morning; in the evening 16,000 units intrathecally and 8000 intravenously. On the fifth day again 16,000 intrathecally and 8000 intravenously. On the sixth, seventh, and eighth days 12,000 units were given each day intrathecally. The general spasms ceased after the first intrathecal and intravenous doses and the trismus was gone in a week. Recovery was complete.

CASE 6.—Shrapnel wound of knee, penetrating joint. Antitoxin same day and again about five days later. Shrapnel removed from joint. Wound healed completely. Movement of knee good. Incubation 48 days. Onset with lumbar pain and sweating. After 24 hours slight rigidity of lumbar muscles. After 43 hours back and neck stiff, marked trismus, sweating, commencing opisthotonic spasms. No symptoms in wounded limb. Serum treatment commenced at end of second day—12,000 units intrathecally and 12,000 intramuscularly. Similar doses next day, and half these doses on day following. Improvement was immediate, and the trismus had nearly disappeared by the fifth day. Recovery complete. Marked serum rash after third intrathecal dose; œdema of face lasted for weeks.

Cases of Subacute or Mild General Tetanus.

CASE 7.—Compound fracture of right mandible by fragment of high-explosive shell. Antitoxin given same day. Three days after injury fragment of shell removed from jaw. A dental splint fitted later. Incubation 19 days. Onset with slight trismus. Tetanus not diagnosed for six days, when the spasm had spread to neck, back, and abdomen; restlessness and delirium. 1500 units antitoxin given subcutaneously on the seventh, eighth, eleventh, and thirteenth days; 1500 intrathecally on the fourteenth day, after which the same subcutaneous doses were repeated, with occasional doses of an antibacillary serum. On the twenty-seventh day there was still some rigidity of the abdomen, with increased knee-jerks and ankle-clonus; on this day the patient had 12,500 units intramuscularly. The tetanus finally disappeared about the fortieth day, but the patient remained delirious till he was put on fuller diet. Recovery was complete.

CASE 8.—Compound fracture of right tibia. Bit of high-explosive shell removed same day and antitoxin given. The wound remained foul, and some two months after the injury the cavity was scraped and dressed daily with phenol and camphor, when it became clean. Incubation 107 days. Onset with slight stiffness of jaw and neck, not recognised as tetanus for a week, when the rigidity was more marked and had spread to the abdomen. The tongue was bitten during the night by a spasm of the jaw. On the eighth day he received 1500 units of antitoxin subcutaneously, and the same on the ninth day. On the tenth day the patient had 12,000 units intramuscularly. The trismus was intermittent, coming on when he ate or when he cleaned his teeth. After it had disappeared he had attacks of local rigidity in the leg when it was dressed. No tetanic symptoms after the eighteenth day. Complete recovery.

CASE 9.—Multiple shell wounds, including compound fracture of left tibia and fibula. Antitoxin given same day. Wounds opened up a few days later. Incubation 17 days. Onset with trismus, which was complete in 24 hours. There was no other sign of tetanus. Patient received 8000 units of antitoxin intrathecally on the second, third, and fourth days of the disease and quickly recovered, all trismus having gone in a week. Slight anaphylactic shock occurred after the first intrathecal dose of serum.

CASE 10.—Gunshot wound of right arm. Compound fracture of humerus. Antitoxin same day. Fragments of bone removed on two occasions soon after. Nearly three months later a loose sequestrum was removed with forceps without cutting, and on the following day blood and pus appeared in the urine, lasting for a few days. Previous to the removal of the sequestrum there had been intermittent stiffness of the jaw. Incubation 83 days. Eight days after removal of sequestrum, there was marked trismus and slight risus sardonicus. The abdominal muscles were rather rigid, but there was no opisthotonos. Occasional spasms occurred in the wounded arm. On the day of definite onset patient had 24,000 units of antitoxin intrathecally and the same on the following day. On the third day 8000 units intramuscularly and 3000 subcutaneously. On the fourth 8000 and on the fifth 3000, both intramuscularly. A week from onset the tetanus had nearly disappeared and the patient thenceforward steadily recovered.

CASE 11.—Gunshot wound. Compound fracture of right tibia and fibula. Antitoxin two days later and again three weeks later. Two operations in France for setting bones and drainage. Wound healed all but a sinus. Incubation 71 days. Onset preceded for five days by painful pricking sensations in back and over scapulæ. Attack began with spasms in wounded leg and back, with opisthotonos but no trismus. The spasms were painful but not very frequent, and were followed by profuse sweating. Constitutional symptoms slight. No serum treatment was given till the sixth day, when rigidity of the abdominal muscles was present, and the right leg was quite stiff. There was no spasm in the left leg, but increased knee-jerk and ankle clonus. On the sixth day patient had an intramuscular injection of 6000 units of antitoxin, and on the seventh day an intrathecal dose of 16,000 units. The opisthotonic spasms ceased after this intrathecal dose. Intramuscular injections of 8000 units were given on the tenth and thirteenth days, and 1500 units on the fifteenth day, when the last spasm in the leg occurred. Decreasing rigidity of the abdominal muscles was observed up to the twenty ninth day. Recovery was complete.

Case of Severe Local Tetanus with General Symptoms but no Trismus.

CASE 12.—Multiple shrapnel wounds, apparently slight, but in reality involving fracture of right ilium, with fragment of shrapnel in pelvis. Antitoxin given on following day. Incubation six days or less. Reached England with left leg rigid. The condition was not recognised as tetanus for three weeks; at this time the left leg was rigid throughout, only partially relaxing under general anæsthesia. Twitchings of the right leg were also present, and the whole muscular system seemed to be in a state of increased excitability, all reflexes being exaggerated. Trismus and opisthotonos were absent. On the twenty first day of the disease the patient had an intramuscular injection of 1000 units of antitoxin. On the twenty-second and on the five following days he had intrathecal injections of 8000 units, six such doses in all. The tetanus subsided very gradually, but ultimately quite passed off. The patient, however, became the subject of grave pyæmic complications, with suppurations in joints, and of these he ultimately died some two months after the tetanus had subsided.

Cases of Local Tetanus with Trismus.

CASE 13.—Shrapnel wound, right buttock. Antitoxin given same day. Missile removed in France. Wound healed and patient was walking about ward. Incubation 50 days. As he was walking the right knee suddenly became "locked," and the whole leg was found to be in a state of tonic spasm. On the fourth day the rigidity began to extend to the loins and there was trismus. The affected leg was rigid as a bar of iron, the rigidity being maintained even under deep general anæsthesia. On the fourth day he had two intramuscular doses of antitoxin, each of 1000 units. On the fifth and sixth days intrathecal injections, each of 8000 units. The tetanus passed away very slowly, but recovery was complete.

CASE 14.—Gunshot wound. Compound fracture of right tibia and fibula. Antitoxin given next day. Tibia united and wound nearly healed. Incubation 55 days. Onset with slight trismus. On the fourth day the right leg was stiff, owing to tonic contraction of the hamstrings. There was an erysipelatous condition about the wound, with irregular fever. On the seventh day there was marked trismus, but no opisthotonos. The abdominal muscles were slightly rigid and the right hamstrings were quite rigid. The patient was sweating and had an anxious look. On the sixth day of the disease he had 1500 units of antitoxin subcutaneously in the morning and 3000 or 4000 units intramuscularly in the evening. On the seventh day 3000 units intramuscularly. On the eighth day 16,000 units were given intrathecally and 8000 intramuscularly. After this he had no more spasms and made a good recovery.

Cases of Local Tetanus without Trismus.

CASE 15.—Shell wounds, left thigh and buttock. Antitoxin two days later. Incubation 84 days. Onset with gradually increasing rigidity of left leg to which, in the course of the next month, painful spasms were superadded. Tetanus was not diagnosed till the rigidity had been going on for more than two months and had to some extent involved the abdominal muscles. The patient now received two subcutaneous doses of 3000 units of antitoxin, then 9000 intrathecally, and then 18,000 subcutaneously on three successive days, followed by 18,000 intramuscularly and again 18,000 subcutaneously. This treatment extended over 10 days, with no immediate benefit, but the spasm gradually disappeared in the course of the ensuing three weeks and he recovered.

CASE 16.—Shrapnel wounds of both hands, both legs, and left eye. Wounds healed, and patient was beginning to try to walk. Incubation four months. Onset with stiffness of right leg, developing into tonic spasm of ham-strings and quadriceps. Spasm not painful. No other sign of tetanus. On the fifth day of symptoms he had 1500 units of antitoxin into the theca; this was followed by a slight rigor and headache. On the eighth day he had 500 units subcutaneously. The patient made a complete recovery.

CASE 17.—Shell wounds of left knee and ankle and left elbow. Antitoxin given. Primary amputation through thigh in France. The stump was unsatisfactory, and 130 days after the injury 1½ inches of the femur were removed. Twelve hours after this spasms began in the stump; they were very frequent and painful and much increased when the stump was dressed or manipulated. No other sign of tetanus was present except lively reflexes. On the day after the spasms began the patient had 1500 units of antitoxin subcutaneously and on the following day 27,000 units intrathecally. Twenty-four hours after the intrathecal injection the spasms were much relieved, but they went on, gradually ceasing, for a week. No further symptoms occurred. No tetanus bacilli could be cultivated from the wound.

CASE 18.—Gunshot wound of right heel, shattering os calcis. Fifteen days later wound opened up and pieces of boot and sock were removed. Pus found tracking up peroneal tendons. On the day after this operation there was pain in the right heel, and 24 hours later (17 days' incubation) painful cramps began in the right calf. These spasms occurred every three or four minutes, knotting the gastrocnemius. There was no tonic spasm. They continued unchanged and finally spread to the hamstrings. On the sixth day the patient had 1500 units of antitoxin subcutaneously, and on the seventh day 5000 by the intramuscular route. There was no immediate improvement, but the spasms gradually disappeared. The case was later complicated by a dangerous gangrenous cellulitis of the buttock and back, but the patient ultimately recovered.

CASE 19.—No wound. Patient came off duty with swollen feet, and cellulitis arose in the right foot, which was incised. Incubation nine days. Onset with twitching of both feet and calves and also of the facial muscles. There was at first some rigidity of the legs, more in the left than in the right. This soon passed off. No trismus and no other sign of tetanus. On the day of onset 16,000 units of antitoxin were given by the intrathecal route and 8000 by the intramuscular. These doses were repeated on the following day, and later some smaller intramuscular doses were given. In about a week from the onset the symptoms had subsided, the facial twitching being the last to go.

CASE 20.—Trench feet, with slight breach of surface over the left internal malleolus. Twenty-nine days later inflammation set in round the malleolus, and the left sterno-mastoid was found to be rigid and contracted. No spasm in leg and no trismus. As a precaution 1500 units of antitoxin were given intramuscularly on the day of onset, and on the following day the same, with 9000 by the intrathecal route. On the third day the sterno-mastoid was nearly relaxed, but the knee-jerks were much exaggerated. Later the patient had pains in various joints, which improved when active treatment was employed for pyorrhœa alveolaris, from which he suffered.

Comments on the Preceding Cases.

Five patients out of the 20 died, but only 4 died from tetanus. One of these received no serum treatment, and 2 more were men unprotected by a prophylactic dose of antitoxin. Of the 16 cases which received intrathecal injection of antitoxin 2 died from tetanus and 1 later from septic complications. Thus if I wished to claim a low percentage mortality I could do so. The total mortality from tetanus was 20 per cent., and amongst the cases treated by intrathecal antitoxin 12½ per cent. Such figures would, however, be worthless as an argument for the intrathecal route, for the cases were a very mixed series, and 6 of them were cases of local tetanus, in which recovery would probably have ensued whatever the mode of treatment. The last three cases were perhaps not tetanus at all; indeed, Case 20 was so doubtful that antitoxin was only given as a precaution, while the medical officer in charge of Case 18 did not agree that it was one of tetanus. A much closer criticism of the cases is required before forming an opinion as to the value of the intrathecal route.

The impression left upon my mind is as follows. Many of the subjects of the most severe tetanus, especially those who have received no prophylactic injection of antitoxin, will die whatever is done. But I should much like so see the effect of really adequate doses (20,000–30,000 units) intrathecally given at the very onset of such cases. At the other end of the scale are the cases of local tetanus, with very low mortality and a tendency to spontaneous recovery, which cannot be used as an argument in favour of any given route. But between these two extremes lies a group of cases in which efficient treatment may turn the scale, and I think that it is by such cases, of sufficient gravity to threaten life, that a mode of treatment should be judged. I should place at least five of the preceding cases in this category—viz., Cases 5, 6, 9, 10, and 11. Some, it is true, were caught so early that dangerous symptoms had not had time to develop—e.g., Case 9—but even here severe trismus with an incubation of only 17 days is a grave condition. All these cases were treated with large intrathecal doses of antitoxin, though other routes were employed as well in most of them, and all made excellent recoveries. I was particularly struck with the rapid improvement which usually followed the intrathecal dose, the spasms often abating in 24 hours.

It may be said, and I cannot disprove it, that equally good results might have been obtained by similar doses of serum by the intravenous or intramuscular routes. My impression, however, is that the improvement was more rapid and striking in these cases than I have seen recorded in cases treated by other routes. I have in mind also a case which recently occurred in St. Bartholomew's Hospital under the care of Dr. T. J. Horder, and which we hope to publish. A woman with moderately severe tetanus received 24,000 units of antitoxin intravenously on the day of admission to the hospital with no benefit; 48 hours later her condition was dangerous and she was given 27,000 units by the intrathecal route with striking results. Improvement was manifest next day and she made a good recovery.

Anaphylaxis.—Meningeal Reaction.—Route in Local Tetanus.

A further matter cannot be ignored in the choice of a route for antitoxic serum; it is the risk of anaphylactic shock in patients who have received a prophylactic dose of antitoxin. Only one of the 16 patients in my series exhibited shock after the intrathecal injection, and it was not severe. Cases of shock, sometimes severe, have been

reported even after subcutaneous injection of a second dose, but such instances are of considerable rarity. Those who employ the intravenous route probably run greater risks, but it seems true that even here shock is exceptional, and that series of cases of tetanus in men who have previously had serum have been treated intravenously without this accident. Nevertheless, everything that we know about anaphylaxis from the experimental side points to the intravenous as the most certain route for producing shock, except perhaps the intracerebral. There is, further, plenty of clinical evidence that the danger is a real one in man; fatal cases, for instance, have been reported lately from the intravenous injection of antidysenteric serum. This is certainly an argument which is of weight with me in my preference for the intrathecal rather than the intravenous route. We know, too, that antitoxin is readily and quickly absorbed from the theca into the circulation, so that the intrathecal route practically accomplishes in a short time all that can be attained by intravenous injection with less risk of shock and with the possible, but unproven, advantage of some direct action upon the central nervous system.

The risk of sepsis from intrathecal injection is one which, with ordinary care, should be negligible. In hundreds of lumbar punctures at St. Bartholomew's Hospital I have never seen it. It may be simulated in mild degree by the meningeal reaction against a large dose of alien protein; slight symptoms of meningeal irritation are sometimes seen, and the reality of the reaction is manifest from the fact that for a day or two after an intrathecal injection of serum the cerebro-spinal fluid is turbid with polymorphonuclear leucocytes. But this seems to do no harm.

One other question remains to be considered. Is it worth while to employ the intrathecal route in cases of local tetanus? The French authorities seem to consider that it is sufficient in these cases to maintain the existing protection by subcutaneous doses of antitoxin. In established cases of local tetanus with no sign of involvement of the higher centres I should concur in this view, for I have seen no great benefit from intrathecal injection in such cases. Nevertheless, Case 17 in my series suggests that in an early case of this condition intrathecal injection may be of benefit, and whenever trismus comes to be superadded I should regard it as indicated. It must be remembered that an insufficiently treated case of local tetanus tends to pass on into the general disease as protection becomes weaker. Of this a convalescent case from France, which I saw when cured, affords a good example. An artillery officer received a flesh wound in the thigh and had antitoxin six hours later. After some nine weeks, when the wound was perfectly healed, though a fragment of shrapnel remained in it, he noticed a little stiffness of the leg in walking. Nevertheless, his leave up, he returned to duty in France and remained at work for a fortnight till his leg grew so rigid that it was helpless, and he went again into hospital. Trismus, stiff neck, and opisthotonos now supervened and large intrathecal doses of antitoxin were given, supplemented by intramuscular. These were continued for 18 days, by which time he was cured.

I may say, in conclusion, that my object in writing this paper has been to confirm the faith of those who believe in the intrathecal route in face of the doubts which have lately been cast upon its value. In my humble judgment, based, it is true, on a limited experience only, it seems the most potent means of saving life in a disease so terrible that one is justified in running some risks in the attempt to cure. And I believe these risks less, and the prospects of cure greater, or certainly not less, than when the intravenous route is employed, while in the presence of the acuter forms of tetanus the delay involved in absorption from the muscular or subcutaneous tissues means the loss of the precious hours during which life may still possibly be saved.

Note.—Since writing the above I have received from Professor C. S. Sherrington the latest details of his experiments. Of 10 untreated control monkeys all died. Of those treated with antitoxin subcutaneously all died. Of 12 treated by intramuscular injection all died. Of 16 treated by intravenous injection 10 died (62·5 per cent. mortality). Of 18 treated by intrathecal injection 5 died (27·7 per cent. mortality). These figures are more favourable to the intrathecal, as opposed to the intravenous route, than I had supposed.

A CASE OF TETANUS; ISOLATION OF THE BACILLUS FROM A VARICOSE ULCER; TREATMENT BY ANTITOXIN; RECOVERY.

By F. W. ANDREWES and THOMAS J. HORDER.

This case on admission to hospital appeared a suitable one for the intravenous administration of serum; but, as will be seen, recourse was later had to the intrathecal route.

Clinical note of the case.—A married woman, aged 44, was admitted to St. Bartholomew's Hospital on Jan. 15th. On Jan. 10th she felt ill, with headache and slight backache. Next day her jaw was stiff. On the third day of her illness the pains in the back increased and the chest was also painful. She was seen by a doctor on the fifth day and was admitted to hospital on the sixth day. On examination the face was flushed, with slight cyanosis; the patient was drowsy and lay with legs abducted. The temperature was 99·4° F., pulse 110, respirations 20. The jaw was rigid, the incisor teeth opening less than quarter of an inch. There was slight cervical rigidity for antero-posterior movements, but not for lateral movements. There was no retraction of the head. The abdominal muscles were stiff. The legs could not be voluntarily adducted. Examination of the left leg showed an old varicose ulcer, of 18 years standing, just above the inner malleolus. The ulceration was very superficial and about 3 by 2 inches in extent. It was covered by very pale and fine granulations. The surrounding skin was pigmented but not inflamed. There was no œdema, no cellulitis and no enlarged glands. On the seventh day of the disease the patient became much worse; the drowsiness increased, the temperature rose to 101°, pulse to 120, and respirations to 30, the cyanosis increased; more serious than these, spasms began early on this day, at first infrequent and mild, but later very frequent and severe. On the evening of the eighth day the temperature reached 102·2°, pulse 128, respirations 42; the patient was unconscious for the most part, with retention of urine. On this day the first intrathecal injection of antitoxin was given. On the ninth and tenth days the patient's general condition was better, and the spasms were no worse. On the eleventh day the second intrathecal injection of antitoxin was given. Gradual progress took place thence onwards. The temperature fell gradually and reached normal on the sixteenth day. The trismus began to relax on the eighteenth day and was almost absent on the thirtieth. The patient got up on the thirty-fifth day, and left hospital quite well on the forty-ninth day.

Serum treatment.—The disease was well generalised, not, at the time, of very great severity, and the patient had not previously received any dose of serum which would have rendered her sensitive. She was therefore given 24,000 units of a potent serum from the Lister Institute, of the value of 8000 U.S.A. units in 10 c.c. which had been placed at the disposal of one of us (F. W. A.) by the kindness of Dr. MacConkey, and which had previously given good results on intrathecal administration in several cases. The effect of this was disappointing, and the patient fell into such a dangerous condition that, two days later, the intrathecal route was adopted. Dr. O'Brien, of Messrs. Burroughs and Wellcome's laboratories, had kindly given one of us (F. W. A.) for trial some concentrated antitetanus serum prepared in the usual way by ammonium sulphate precipitation of the globulin fraction and re-solution. It contained double the ordinary amount of protein, and had a value of 27,000 U.S.A. units in 12 c.c.

The cerebro-spinal fluid.—Of the specimen removed at the time of the first intrathecal injection Dr. Stansfeld reported as follows: The fluid is quite clear and colourless, the cells present are not increased in number, the protein is in very small amount (too small for estimation), and the reducing power is normal. Of the specimen removed at the time of the second intrathecal injection, three days after the first, Dr. Canti reported as follows: Quantity, about 15 c.c.; colourless; fine flakes present; no admixture of blood; cells, 470 per c.mm.; lymphocytes, 10 per cent.; polymorphs, 86 per cent.; endothelium, 4 per cent.; the protein amounted to 0·025 per cent., and globulin was present; Fehling's reduction normal; sterile in film and culture. This report illustrates the well-known phenomenon of mild meningeal irritation with polymorphonuclear leucocytosis following the injection of alien serum into the intact subarachnoid space. It is apparently devoid of serious import.

Bacteriology.—The ulcer was examined by one of us (F. W. A.) the day after admission. In stained films the predominating organism was a staphylococcus, but many long thin bacilli were present which would have passed as tetanus though no sporing forms were seen. Anaerobic meat-broth tubes under liquid paraffin were inoculated with the secretion, and yielded an abundant growth of *B. tetani*, from which the staphylococci were later eliminated by heating. The toxicity of the culture was marked; mice inoculated with 1/1000 and 1/2000 c.c. developed intense tetanus in 24 hours; smaller doses were not tried. The heated cultures were not pure tetanus; in a subculture given to the Lister Institute the malignant œdema bacillus was also found present by the workers there. Eleven days after the patient's admission to hospital the ulcer was examined again. With the rest in bed it had completely healed, and was covered with a thin layer of new epidermis. Nevertheless, a swab rubbed over the cleansed surface, at the point where the healing appeared most recent, yielded a culture of *B. tetani* as abundant as the first. The site of the ulcer was now dressed daily with a paste of "eupad"; after a week of this treatment no more tetanus bacilli could be cultivated.

General comments.—There was no trauma in this case, nor was there any suggestion as to the manner in which the varicose ulcer became infected, nor how long it had been infected. This particular channel for infection is probably very unusual, and worthy of record. But a more important reason for referring to the case is that in it the effect of a single intrathecal dose of 27,000 units of antitoxin on the eighth day of the disease was so marked that it is difficult to believe it due to anything but the change of route. It is true that a different brand of serum was used for this intrathecal injection from that used intravenously 48 hours earlier. But both brands had been used by one of us (F. W. A.) in several cases, and there was no reason for supposing the one serum better than the other. It is, of course, just possible, though not probable, that the good results following so quickly upon the intrathecal dose were a delayed effect of the intravenous dose. The second intrathecal dose was given as a precaution and not from any urgent necessities of the case.

A COMPARISON OF SUBCUTANEOUS WITH INTRAVENOUS AND INTRATHECAL ADMINISTRATION OF TETANUS ANTITOXIN IN EXPERIMENTAL TETANUS.

BY F. GOLLA, M.B., B.CH. OXON.,

CAPTAIN, R.A.M.C. (T.F.); MEMBER OF THE WAR OFFICE COMMITTEE FOR THE STUDY OF TETANUS.

(*From the Physiological Laboratory of the University of London.*)

THE War Office Committee for the Study of Tetanus has, in a memorandum, emphasised the advantages of serum treatment in tetanus by the intrathecal method.

With a view of testing in animals the relative efficiency of the administration of antitoxin by the subcutaneous, the intravenous, and intrathecal methods in tetanus, a series of experiments has been made on cats and on rabbits injected with equivalent doses of tetanus toxin.

The results obtained show the indubitable superiority of the intravenous and intrathecal routes over the subcutaneous. Such superiority may be attributed to the slow absorption of tetanus antitoxin injected subcutaneously.

It will be seen by reference to Table III. that even when injected 24 hours later, antitoxin by the intrathecal route is more efficient than the subcutaneous injection.

None of the results gave any encouragement to the view that toxin may be neutralised once it has entered the nervous system. The whole problem of the serum therapy of tetanus appears to be that of cutting off fresh supply of toxin by bringing antitoxin into relation with the focus of infection as rapidly as possible. In animals with a high resistance to tetanus, such as cats and rabbits, the symptoms develop comparatively slowly; in the susceptible guinea-pig the development is much more rapid even if we make allowance for the shorter nerve path traversed by the toxin to reach the central nervous system. Man is much more akin to the guinea-pig in susceptibility, and in the unprotected subject symptoms may develop from a local spasm to generalised tetanus with startling rapidity. The greater swiftness with which antitoxin can be brought into action by intrathecal and by intravenous administration rather than by subcutaneous should therefore be of paramount importance in treatment. This fact has been to some extent obscured during the present war owing to prophylactic administration of serum having converted man from a susceptible to a resistant organism, and this is evidenced by the occurrence in the majority of cases of a clinical picture of tetanus which had previously been very rare in the human subject, though it is the rule in highly resistant animals such as the cat and the rabbit. The disease first manifests itself in local spasms of the muscles supplied by the spinal segments directly in nervous continuity with the wound. It may either remain localised or more or less slowly invade the whole nervous system. In such cases the better results obtained by intravenous and by intrathecal administration are not always so apparent, but since it is impossible to say whether or not a sudden rapid invasion of the whole central nervous system may develop, it would appear to be courting needless risks to delay the bringing into action of antitoxin by adopting the subcutaneous method.

The appended series of four experiments illustrate the points referred to above.

COMPARISONS OF SUBCUTANEOUS WITH INTRATHECAL INJECTIONS OF ANTITETANIC SERUM BEFORE ONSET OF TETANIC SYMPTOMS.

EXPERIMENT 1.—*Four Rabbits received Injection of Tetanus Toxin 160 + ms. per g. in Left Gastrocnemius. No Tetanus within 24 hours. Each Rabbit received 75 U.S.A. Units of Antitoxin per kg. 24 hours after Toxin.*

No. of rabbit.	Site of injection of antitetanic serum.	Result.
128	Subcutaneous.	48 hours after toxin marked rigidity of left leg. Died of general tetanus on fourth day.
129	Intrathecal.	48 hours after toxin slight rigidity of left leg. Passed off after three days. Recovered.
130	Subcutaneous.	48 hours after toxin marked rigidity of left leg. 12 hours later left anterior extremity affected. Rigidity of left leg lasted one month. Recovered.
131	Intrathecal.	48 hours after toxin slight rigidity of left leg. Recovered completely in three days.

EXPERIMENT 2.—*Three Cats received Injection of Tetanus Toxin 40 + ms. per g. in Left Gastrocnemius. No Tetanus within 24 hours. Two Cats received 75 U.S.A. units of Antitoxin per kg. 24 hours after Toxin.*

No. of cat.	Site of injection of antitoxin.	Result.
104	Subcutaneous.	Marked rigidity of left leg. Lasted till killed a week later.
105	Intrathecal.	Slight weakness of left leg. Passed off in three days. Recovered.
106	No injection.	Marked rigidity of left leg. Anterior left extremity also affected. Lasted till killed a week later.

COMPARISON OF SUBCUTANEOUS WITH INTRATHECAL INJECTION OF ANTITOXIN BEFORE AND AFTER THE ONSET OF TETANIC SYMPTOMS.

EXPERIMENT 3.—*Ten Rabbits received Injection of + 160 ms. per g. Toxin in Left Gastrocnemius.*

Time after toxin.	State at time of injection of antitoxin.	Subcutaneous injection of 100 U.S.A. units antitoxin.	Intrathecal injection of 100 U.S.A. units antitoxin.
24 hours	No local tetanus.	No. 144 developed marked rigidity 40 hours after toxin. Died fourth day.	No. 147 slight rigidity 36 hours after toxin. Recovered four days.
36 ,,	Slight local spasm.	Nos. 145 and 146 rigidity increased. Died fourth day.	Nos. 148 and 150 rigidity increased; forelimbs affected next day. 148 recovered. 150 died sixth day.
48 ,,	Marked local spasm of left leg and weakness of anterior extremities.	Nos. 149 and 151. Died fourth day.	Nos. 152 and 153 no amelioration of symptoms. Died fifth and sixth days.

INTRAVENOUS INJECTION OF ANTITOXIN COMPARED WITH SUBCUTANEOUS AND INTRATHECAL INJECTIONS.

EXPERIMENT 4.—*12 Rabbits received Injection of 100 + ms. per g. Toxin in Left Gastrocnemius.*

Time after toxin of antitoxin injection and state of rabbit.	Subcutaneous injection 100 U.S.A. units.	Intravenous injection 100 U.S.A. units.	Intrathecal injection 100 U.S.A. units.
24 hours. No tetanic symptoms.	A. and B.: Rigidity (local) 36 hours after toxin. Died third day.	C. and D.: Slight local rigidity 36 hours after toxin. Well-marked rigidity of left leg 12 hours later. Forelimbs not affected. Recovered.	E. and F.: Slight rigidity left leg 36 hours after toxin. No increase of symptoms. Recovered.
48 hours. Well-marked rigidity of left leg.	G. and H.: Anterior extremities affected 60 hours after toxin. Died third day.	J. and K.: Rigidity remained localised to left leg. Recovered.	L. and M.: Next day L. showed paresis of both forelimbs. Died fifth day. M. slight rigidity of left forelimb and paresis of right next day. Recovered.

A STATISTICAL NOTE ON AN ANALYSIS OF CASES OF TETANUS IN THE BRITISH EXPEDITIONARY FORCE.

BY M. GREENWOOD, JR., M.R.C.S. ENG., L.R.C.P. LOND.,
CAPTAIN, R.A.M.C. (T.F.); READER IN MEDICAL STATISTICS, UNIVERSITY OF LONDON.

(From the Lister Institute of Preventive Medicine.)

IN THE LANCET of Jan. 27th (pp. 131 *et seq.*) Colonel Sir William Leishman and Major A. B. Smallman published an analysis of the cases of tetanus, 157 in number (neglecting three cases respecting which no details were given), which had occurred in hospitals in France between July 1st and Oct. 31st, 1916. These authors, while fully admitting the fragmentary character of their material, felt justified in enunciating a few practical conclusions. They held that the results threw "very considerable doubt upon the advisability of employing the intrathecal route, either alone or in combination, and, further, they seem to indicate considerable virtue in connexion with the employment of the subcutaneous and intramuscular channels, particularly the latter." In a summary of conclusions (ibid., p. 137) this judgment is reiterated, the evidence available with respect to the intrathecal method being described as "pretty strongly against its employment." Colonel Leishman and Major Smallman adduce certain theoretical and technical considerations in support of their condemnation of the intrathecal route, but their chief argument is founded upon the results of statistical tabulation, in particular upon the fact that while of 111 patients treated wholly *or in part* by the intrathecal method, 84 (76 per cent.) died; of 32 patients treated wholly *or in part* by the intramuscular route, only 19 (59 per cent.) succumbed.

Analysis of Statistical Results.

The fundamental data appear in Colonel Leishman and Major Smallman's Table VII. (here reproduced, with some additions, as Table I.), which records the numbers of deaths

TABLE I.—*Fatalities in Different Groups. Observed by Leishman and Smallman.*

T, Intrathecal; V, Intravenous; S, Subcutaneous; M, Intramuscular. The figures in brackets are the "expected" deaths deduced from the mean rate of fatality.

Method of administration.	No. of cases.	No. of deaths.	Fatality per cent.	Method of administration.	No. of cases.	No. of deaths.	Fatality per cent.
T	25	21 (18·31)	84	S M	1	1 (0·73)	100
V	7	7 (5·13)	100	T V S	20	17 (14·65)	85
S	27	15 (19·78)	55	T S M	4	1 (2·93)	25
M	4	3 (2·93)	75	T V M	5	3 (3·66)	60
T V	14	11 (10·26)	78	V S M	1	1 (0·73)	100
T S	28	21 (20·51)	75	T V S M	2	1 (1·47)	50
T M	13	9 (9·52)	69				
V S	4	4 (2·93)	100				
V M	2	0 (1·47)	0	Totals ..	157	115	—

and recoveries distributed in 15 sub-groups, each sub-group being composed of individuals treated by a different method or different combination of methods. The authors comment on this table in the following words:—

> The uneven size of the groups and their very number make evident the futility of any attempt to form conclusions from a consideration of the degree to which the case mortalities are above or below the mean rate of the whole 157 cases.

I cannot concur with Colonel Leishman and Major Smallman in this reasoning, which, if correct, would force us to abandon the application of statistical methods to all frequency systems except those in which the sub-group frequencies are sensibly equal. On the contrary, I think an analysis of this table should be the first stage of the inquiry. What we seek to learn in the first instance is whether the variations in the case mortalities of these 15 groups are greater than might reasonably be attributed to the operation of pure chance, to the fluctuations which occur among small groups of individuals taken at random from a population experiencing a rate of loss identical with the mean rate—viz., 73·2 per cent. Clearly if the fluctuations are not greater than might often occur in this way, we cannot expect to derive any useful information as to which of the 15 methods, or combinations of methods, is the best to employ in future.

Two methods can be used to answer this fundamental question.

The first is to divide the difference between the number of deaths actually observed in each group and the number expected (on the assumption that the mean rate applies to all alike) by the latter's standard deviation and then to ascertain whether the resulting 15 reduced deviations are effectively distributed in accordance with the normal curve of errors.

The second method is to form a table with 30 compartments, corresponding to the complete distribution of the individual records, and then to compute the value of the function X^2 for the whole table. Thus, the chance that an individual observation which falls into the group T will fall also into that of recoveries is $25/157 \times 42/157$, and the number of such observations will be 157 times this—i.e., 6·69—and a similar calculation gives us the remaining *a priori* values.

If the difference between this "expected" value and the observed value be squared and the square divided by the "expected" value, the sum of the resultant numbers will measure the divergence between the calculated and observed result and, from published tables, the probability of such a divergence having arisen by chance can be computed.

Theoretical objections can be urged against either method; with greater force perhaps against the former owing to the small size of several of the groups and the consequently hazardous assumption that the distribution is normal. They are, however, sufficiently accurate for our present purpose. Taking the first method, we have the results shown in Tables II. and III. The agreement between observation and

TABLE II.

Group.	Difference between observed and expected deaths.	Standard deviation of expected deaths.	Difference divided by standard deviation.	Group.	Difference between observed and expected deaths.	Standard deviation of expected deaths.	Difference divided by standard deviation.
T	+ 2·690	2·213	+ 1·216	V M	− 1·465	0·626	− 2·340
V	+ 1·873	1·171	+ 1·599	S M	+ 0·267	0·443	+ 0·603
S	− 4·778	2·300	− 2·077	T V S	+ 2·340	1·980	+ 1·187
M	+ 0·071	0·885	+ 0·079	T S M	− 1·930	0·886	− 2·178
T V	+ 0·745	1·656	+ 0·450	T V M	− 0·663	0·990	− 0·670
T S	+ 0·490	2·342	+ 0·209	V S M	+ 0·267	0·443	+ 0·603
T M	− 0·523	1·596	− 0·328	T V S M	− 0·465	0·626	− 0·743
V S	+ 1·070	0·885	+ 1·209				

TABLE III.

Deviation.	Observed.	Expected.
Greater than + 1 S.D.	4	2·38
0 — + 1 S.D.	5	5·12
− 1 S.D. — 0.	3	5·12
Greater than − 1 S.D.	3	2·38

expectation is such that were the assumption really correct we should expect on repeating the experiment to find, on the average, no better agreement in 55 per cent. of our trials.

Passing to the second test, we have $X^2 = 23·5375$, which corresponds to $P = 0·751$, or odds of three to one that in the long run we should get as bad a result, or a worse result, as the experiment actually shows. Consequently either path leads us to the same conclusion—viz., that the variations of case mortality from group to group are such as might easily arise by chance within a uniform population. A corollary is that we cannot properly draw any conclusion at all as to which method of administering the antitoxin is practically the best. In view of the results just detailed, it is hardly necessary to carry the investigation further, but a few remarks on Colonel Leishman and Major Smallman's subsequent tabulations are permissible.

Difficulty arising from Scantiness of Data.

These investigators being sensible that the numbers of cases treated solely by one or other of the methods they desire to contrast—viz., intrathecal and intramuscular—were too scanty to warrant definite conclusions, sought to overcome the difficulty by widening the groups. This they have done by contrasting all the groups in which intrathecal injections formed a portion of the treatment with all those in which intramuscular injections were employed.

The result is that 24 out of the 32 cases forming the combined M group, 75 per cent. of the total for that group, also figure in the combined T group with which it is contrasted. It is to be feared that an initial scantiness of data cannot be remedied by so simple an expedient. If we desire to contrast the pharmacological actions of two drugs and have small numbers of observations relating to the separate action of each drug, the addition to each homogeneous group of a heterogeneous set of observations involving the action of both drugs can only blur the difference without in any way increasing the reliability of the original experiments; obviously the larger the heterogeneous group added in, the nearer must the mean of each aggregate approach to that of the heterogeneous group. If we suffer from a shortage of potatoes, we shall remain short of potatoes no matter how many pigs fattened on potato parings may be brought to market. I think, therefore, that the comparison must be restricted to that of groups involving T but not M with those involving M but not T. In the former category we have 87 cases with 70 deaths, in the latter 8 cases with 5 deaths.

The usual method of comparing these results is to take as the probable rate of mortality for both groups $\frac{70+5}{87+8}$ and contrast the observed difference between the two rates with the probable error of the difference. We have: Actual difference, 0·1796; standard deviation, 0·1506; probable error, 0·1016. Assuming the distribution of errors to be normal, we should expect to get a deviation of this magnitude, positive or negative, or greater, once in 4·3 trials.

Another method is to inquire what the chance may be that after 70 deaths have occurred in 87 cases a second sample of 8 would provide 5 or fewer deaths, it being assumed that we have no knowledge of the "real" case mortality other than that furnished by the samples themselves. Making the necessary calculations,[1] we find that the chance is 0·2148, or the event such as will occur on the average once in every 4·7 trials.

Neither test raises any serious presumption that the T group differs from the M group to a degree inconsistent with the belief that the result is a mere chance variation. I conclude, therefore, that Colonel Leishman and Major Smallman's statistics are altogether inadequate to support any argument in favour of or against one or other method of treatment. Pending the collection and analysis of fuller statistics, the clinician must decide what course to adopt upon other than statistical considerations.

NOTE ON A BACILLUS RESEMBLING *B. TETANI*.

BY R. S. ADAMSON, M.A. CANTAB., B.S. EDIN.,
AND
D. W. CUTLER, M.A. CANTAB., B.SC. LOND.
FROM THE DEPARTMENT OF PATHOLOGY, UNIVERSITY OF MANCHESTER.

(*Report to the Medical Research Committee.*)

IN the course of the bacteriological examination of cases of septic and gangrenous wounds in patients in the 2nd Western General Hospital we have noticed on nine occasions in films, and have four times isolated, once from a blood culture taken after the death of the patient, an anaerobic bacillus closely resembling in appearance the *Bacillus tetani*. Two of the four patients from whom the bacillus was isolated had developed tetanus. As the organism does not seem to be generally known it seemed advisable to publish a preliminary note on the subject, pending further studies which we hope to publish shortly.

The bacillus is a strict anaerobe and does not grow in the presence of oxygen. We have always grown our cultures in a Bulloch's chamber at 37° C. The bacillus is characterised by the production of large terminal spores which are quite round. The body of the bacillus is large, the average length being between 6 and 7μ, though occasionally individuals as long as 12μ have been seen. In width it is more constant, varying between 1 and 2μ, but generally between 1 and 1·5μ. These measurements do not include the terminal spore. The spore itself is quite round and varies from 1·7μ to 2·2μ in diameter, the normal size being about 1·8μ. These measurements are considerably greater than those of the true *B. tetani*, which measures in length 2–4μ and in width 0·3 to 0·5μ, according to Lingelsheim, who gives 1μ to 1·5μ as the spore width.

The bacillus is motile, but the movement is never rapid and quickly disappears in the presence of air. Old cultures do not show any motility. On glucose-agar plates incubated for five to seven days the bacillus produces rather large colonies, whitish or pale grey in colour, and of a moist consistency. These colonies are usually circular and regular in outline with a raised centre. On very moist plates the organism may produce a transparent dendritic growth, appearing as fine branching lines radiating from a centre. The bacillus grows well on agar and glucose-agar; on Dorset's egg medium it produces a quite superficial growth, the colonies being circular and white, but no digestion or discolouration of the medium takes place. Growth on inspissated serum is very poor, and the organism fails to grow freely in ordinary broth, though it grows well in glucose-broth. In deep stab cultures in glucose-agar a moderately free growth occurs along the needle track, but does not produce threads radiating into the medium. Little or no gas is produced.

On Hiss's serum-water sugars the reactions are constant and characteristic. The organism ferments glucose, lactose, and maltose with the production of a slight amount of acidity, but no clotting of the serum or gas production. Cane sugar and mannite are not changed. In litmus milk distinct acidity is produced without clotting, and a slight degree of peptonisation occurs. Peptonisation, however, does not proceed far, and there is no separation of the medium into layers which is so marked a feature of *B. œdematis maligni*. Gelatin is not liquefied and no indol is produced in broth cultures.

The bacillus is Gram-negative, though young cultures, especially in broth, may be Gram-positive. Commonly, however, the bacillus exhibits irregular staining reactions having Gram-positive spots or bands on a Gram-negative background. These spots, however, do not seem to have any constant position. Young spores appear to retain the stain by Gram's method. The bacilli are generally isolated, though chains of two to four or six individuals may occur. They have rounded ends, though one or both ends may appear tapering. Spores are freely produced on all media and seem always terminal in position.

As the result of preliminary experiments kindly carried out for us by Professor H. R. Dean, the organism does not seem pathogenic to guinea-pigs or rabbits in pure culture or in mixed cultures with this bacillus as the predominant form. Inoculations of pure or mixed cultures into guinea-pigs have failed to produce any symptoms suggesting tetanus.

Other authors have described anaerobic bacilli with round terminal spores resembling *B. tetani*, as, for instance—

San Felice's Anaerobe IX. (1893) or *Pseudobacillus of tetanus*. This organism is described as liquefying gelatin, and the photographic figures of the colonies do not at all resemble those produced by our organism. San Felice considers his organism to be a non-toxic strain of *B. tetani*.

Tavel (1898) has described an anaerobic bacillus which he isolated from abscesses and inflammatory conditions of the intestine and appendix, which he calls a *pseudotetanus bacillus*. He describes it as a long and slender bacillus easily distinguished from the true *B. tetani* on account of the fact that the terminal spore is oval and not round. This is a quite different organism, and in its form and cultural characters which he describes seems to resemble the Hibler IX. bacillus more than any other.

The *Bacillus putrificus* of Bienstock has been described as resembling that of tetanus in appearance, but its cultural reactions according to Macé and Muriel Robertson seem closer to those of *B. œdematis maligni* than to any other organism. Further the latter author describes the bacillus as having oval spores.

Owing to the well-known difficulty of isolating *B. tetani* in pure culture and to the ease with which our organism may be confused with it in mixed cultures or pus films, a summary of some of the main differences is given.

This organism is considerably larger and broader than *B. tetani*, also characteristically Gram-negative. This feature, however, may be overlooked owing to the irregular staining mentioned above.

The reactions of *B. tetani* on carbohydrate media do not seem to have received much attention. Macé says that there is no production of acid on glucose, and this is confirmed by the observations made by Dean and Mouat (1916) on a single strain. Lingelsheim and also Robertson say that in milk casein is precipitated and digested. The latter author also states that meat is blackened, with the production of a putrid odour; our organism does not react on the medium in

[1] Pearson, Phil. Mag., 1907, p. 365; Greenwood, Biometrika, 1913, x., p. 69.

this way. These authors also state that *B. tetani* liquefies gelatin, which does not occur with our organism.

Differences in colonies, though never of any great value, are well marked between the two organisms. The wavy outline of the *B. tetani* colonies is not seen, nor does our organism produce the branching and rounded processes in streak cultures. The branches we have described as "dendritic" are not characteristic, and when produced are fine and thread-like and almost completely transparent.

Finally, a very marked difference between the two is the apparently complete absence of toxin production.

Conclusions.—We regard the bacillus which we have described as a member of the large group of intestinal anaerobic bacteria which includes not only *B. tetani*, *B. œdematis maligni*, and *B. aerogenes capsulatus*, but also in all probability a large number of other as yet imperfectly differentiated varieties.

The microscopical and cultural characterictics appear to differ in important particulars from the already described members of the group. The microscopical appearances, indeed, closely resemble those of *B. tetani*, for the spore is round and absolutely terminal, and the possibility occurred to us that we might be dealing with atoxic strains of the tetanus bacillus. We are, however, at present inclined to the view that we are dealing with a distinct variety of bacillus, for not only did all four strains fail to produce toxin but their cultural characteristics on the media above described differed in essential details from those of *B. tetani*.

The injection of pure cultures failed to produce any effect in rabbits and guinea-pigs; a result which does not necessarily imply that this bacillus is incapable of taking part in the production of morbid changes in a septic wound. It is well known that pure cultures of *B. œdematis maligni*, *B. tetani*, and other members of the group may fail to produce any lesion after experimental inoculation. Investigations on this point are in progress, but the microscopical appearances of this bacillus so closely resemble those of *B tetani* that we have thought it desirable to publish a short preliminary note. It is obvious that the occurrence of this bacillus in septic wounds adds considerably to the difficulty of diagnosis of tetanus by purely microscopical methods.

In conclusion, we desire to express our thanks to Professor Dean, under whose direction the investigations have been carried out.

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A CASE OF TETANUS TREATED BY INTRATHECAL AND INTRAMUSCULAR INJECTION OF ANTITOXIN.

BY JOHN GOW, M B MANCH., F.R C.S. ENG.,
ASSISTANT RESIDENT SURGICAL OFFICER, MANCHESTER ROYAL INFIRMARY.

THE interesting features of the case here described are the success of the combined intrathecal and intramuscular injections and the use of the high dorsal injection, the arm being the principal site of spasm.

W. M., aged 32, was hit by shrapnel on Sept. 18th, 1916, receiving multiple superficial wounds on both hands and the left thigh. He was dressed at once, and a few hours later a piece of shrapnel was removed from his right hand. He does not remember receiving any prophylactic injection of antitetanic serum. He reached this hospital on Sept. 23rd, where his wounds were treated by saline fomentations and baths. On Oct. 2nd, at 4 A.M., he noticed that his jaws were stiff so that he could not open his mouth, and an hour later he began to have violent and painful cramps in the right arm, in which he had not previously noticed any symptoms. Seen at 10 A.M. on that day his temperature was 99·6° F. and his pulse 130; he was sweating profusely and had great pain in the right arm. The small superficial wound on the left thigh was granulating, but still discharging a little pus; the wounds of the left hand were dry and healing under scabs; on the right hand were multiple, small, superficial wounds, some healing under scabs, some discharging a little pus. The right arm was flexed at the elbow and wrist, the fingers partially flexed at the metacarpo-phalangeal and extended at the interphalangeal joints. The flexor muscles of wrist and fingers were in a state of tonic contraction and violent spasms were occurring at intervals of about five minutes. The patient was holding the fingers of the right hand with his left to prevent flexion, and whenever he released them violent spasms occurred. The masseters were tense and the posterior neck muscles were stiff. The left arm was not stiff, but the triceps-jerk was exaggerated. Knee-jerks and plantar reflexes were exaggerated, especially on the right side.

At 10 30 A.M., under anæsthesia, 5000 units of antitoxin were injected into the spinal theca in the lumbar region and 10,000 units were given intramuscularly. At 6 P.M. the patient was worse, the spasms occurring every two minutes. In view of the fact that the spasms were most marked in the muscles innervated by the nerve cells of the cervical enlargement, it was decided to inject the serum at a high level. Accordingly, on Oct. 3rd a needle was inserted between the first and second dorsal vertebræ; cerebro-spinal fluid was withdrawn,[1] and 4500 units of serum were injected. On Oct. 4th 5000 units were injected intramuscularly. On Oct. 5th the patient began to improve, and on this and two succeeding days 4500 units were given intramuscularly. On the 8th a generalised antitoxin rash developed and the patient seemed much worse; 4500 units were injected into the subarachnoid space between the first and second dorsal vertebræ. On the 9th the patient was much better again and afterwards progressed well, the spasm very gradually passing off from the masseters and the arm muscles. On the 14th 4500 units were injected intramuscularly.

The patient was discharged to convalescent hospital on Nov. 6th.

[1] The cerebro-spinal fluid withdrawn from the dorsal region 24 hours after the injection of 5000 units into the lumbar region was found to contain antitoxin. Details of this observation are given in a paper on "Twenty-five Cases of Tetanus," by Professor H. R. Dean, which is published in the present issue of THE LANCET.

Reviews and Notices of Books.

Makers of the XIXth Century: Herbert Spencer. By HUGH ELLIOT. London: Constable and Co., Limited. 1917. Pp. 330. Price 6*s*.

THIS is an excellent estimate of Herbert Spencer's life-work, made piquant by the personal attitude of the author towards that work. Mr. Elliot says in his introductory chapter that it has been his fortune to read through the whole of Spencer's works twice at an interval of 15 years, and each time during the progress of a great war. His first reading began when on active service in South Africa, when he found Spencer's doctrine of social freedom irresistibly attractive. During the progress of the present war he again read Spencer's furious declamation against warlike and military activities and found in many parts the arguments to be ill-founded, in other parts the conclusions to be false, while the style which formerly appeared to him so lucid now seemed hopelessly monotonous. Starting with this frank revelation of his estimate of Spencer as a guide and an informer, it is a great accomplishment on Mr. Elliot's part to make us see that though his views of Spencer, even in their most depreciatory sense, are just, yet his subject was none the less a powerful instrument for good in the civilisation of the world. No one can read this life of Herbert Spencer without feeling that the philosopher's central teachings concerning the evils of war and the dangers of military dictatorship were and are sound, and that although his social scheme was impracticable when he devised it, his arguments for its development are magnificently conceived and lucidly advanced. Much of his teaching has, indeed, passed into such common acceptance as to be disregarded as platitudes in modern discussions, and there are many writers and speakers to-day who rest their claims for this or that reform upon evidence which was marshalled originally by Spencer, and which in the course of half a century has become part and parcel of the general mental equipment. These things Mr. Elliot brings out forcibly.

Herbert Spencer's life, though barren of interesting happenings in the ordinary sense of those words, was a far more singular one than that of many men of action or of

letters. Our statesmen and warriors, for the most part, have shone in the spheres for which they have been prepared or in which they have been able to acquire personal influence and prestige; and, despite notable exceptions, our great writers have usually been endowed early with the training necessary for them if they are to acquire learning before imparting it. Spencer's education may have been thorough, but it was meagre, and ceased when he was a lad; determined to lay down general laws for the proper conduct of life in a most detailed and comprehensive sense of the word, he touched real experience at but few points personally, and those were uninspiring; he had little acquaintance with the great literatures of the past and present upon which to draw for the analogies that might have helped him, or by which he could have corrected or reinforced his views; he never enjoyed any position of academic authority. Yet he became the most widely-read author on sociology that this country has ever produced, and, indeed, through his writings was the first to make the world take a thorough and candid inspection of itself. Even to-day, when that world is furiously engaged in demonstrating the utter impossibility of attempting much towards the carrying out of Spencerian doctrines, Spencer has the laugh on his side, inasmuch as had those doctrines become the inspiration of national politics when he uttered them the war would not have been fought. The man who did these things had an amazing life despite its apparent drabness.

Mr. Elliot's book is in the main an epitome of Spencer's works and theories, and it is so ably done that he may have wrought Spencer the disservice of introducing him to an audience which will find that, having assimilated the essence of the teachings, there is no need to attempt the digestion of the mass. Mr. Elliot's warning is clear here. "If," he says in his concluding chapter, "we Spencerians have imbibed the true feelings of liberty and reason, we shall be the first and not the last to criticise the dogmatic theories of Spencer. And we shall believe that there is still no finer introduction to the sciences of biology, of psychology, of sociology, and of ethics than is to be found in Spencer's monumental works on these subjects." We consider ourselves that no one should attempt to write on sociology generally, or to lay down plans for the better development of the world, without having mastered Spencer's fundamental theories. He aimed at establishing a fundamental distinction between two main types of developed society, these being the much governed, where for military necessity it is necessary that the activities of individuals should be subordinated to the needs of the State, and the loose organisation where social evolution follows industrial and commercial directions; the history of the world as it is now being written confirms much of what Spencer argued in arriving at this classification. Similarly Spencer's views on education, though they are not consistent, should certainly be read at their source. His little book on education is, as Mr. Elliot says, the foundation of all the so-called "modern" ideas in education, while his opposition to a scheme of national education strikes us to-day as hopelessly reactionary, even though some of his warnings against the great expectations of the education reformers have been amply justified. This is made the subject of a brief but interesting discussion by Mr. Elliot, who, however, has not made clear throughout the chapter when he is speaking himself, and when he is reproducing the words or ideas of Spencer.

This interesting book establishes the undeniable claim of Herbert Spencer, under a cloud as his fame now is, to be ranked among the "Makers of the XIXth Century." That he was unsound in his treatment of the forces of heredity, and illogical in his metaphysical meanderings cannot alter the fact that he devised, unaided save in mechanical directions, a system of philosophy which swayed the intelligences of his generation, wrote a brilliantly original work on psychology, and, to quote his biographer, "established the Science of Sociology in England." Those who are tempted now to make or renew acquaintance with Spencer's works will find Mr. Elliot's book, and its bibliographical and chronological information, an invaluable introduction. Their time will not be wasted. When the nations turn, after the upheaval of furious and almost universal war, to undertake the task of repair, and when lines of reconstruction are being sought which may ensure the world against a recurrence of the tragedies now under enactment, in Spencer's ideals there will be found much assistance and encouragement.

Il Nuovo Metodo Italiano per la Cura Antirabbica. By Professor CLAUDIO FERMI, Superintendent of the Institute of Hygiene of the University of Sassari. Rome: Via Sistina 14. 1916. Pp. 164. Price 3 lire.

THE object of this little work is to describe the author's method of treating rabies and to point out its advantages over the vaccines of Pasteur, Calmette, Babes and others, and this the author seems to have done with considerable success owing to the vast number of experimental researches undertaken by him, while the proof of its efficacy is to be found in its extensive adoption in India. Fermi's vaccine consists of an emulsion of 5 per cent. of a powerful virus from rabbit or dog, carbolised to 1 per cent. Pasteur and Calmette both used the medulla, but Fermi uses the cortical brain matter. Antirabic serum is obtained from the horse by using this vaccine as antigen, and the serum vaccine used by him is a mixture of 1 part serum and 2 of vaccine with 1 per cent. phenol. In treatment the patient receives during 5 to 10 days two daily injections of 3 c.c. of this serum vaccine, then for another 15 or 20 days two daily injections of 3 c.c. of vaccine alone are given. The treatment can be carried out at the patients' homes, as both the serum and vaccine, since they remain active for one to two months, can be put up in ampoules and sent for long distances. The object of injecting serum as well as vaccine at first is to introduce into the patient as large a quantity of antibodies as possible, and thus to prevent even those cases of rabies which incubate rapidly. By this method Fermi's unsuccessful cases were nil and partial failures—i.e., mortality during the course of treatment—were only 0·1 per cent. Experiments on animals also showed a superiority of 30, 50, and even 100 per cent. over the methods of Pasteur, Calmette, and Babes. A further advantage is simplicity of preparation, Pasteur's method requiring attenuation of the virus by drying, Calmette's by immersion in glycerine, and Cumming's by dialysis. Semple, director of the Central Research Institute at Kasauli, in India, introduced a modification of Fermi's method, in which he renders a virus of 8 per cent. completely avirulent by keeping it for 24 hours at a temperature of 37° C. and diluting at the moment of using it with half its bulk of physiological salt solution. But Fermi is of opinion that this preparation is not sufficiently sterile and is not so efficacious as his own serum vaccine; moreover, it is less convenient to use and more difficult to prepare, while his experiments on animals, comparing the two preparations, showed that while Semple's modification saved 66 per cent. of inoculated dogs, Fermi's method saved 100 per cent.

An Index of Differential Diagnosis of Main Symptoms. By Various Writers. Edited by HERBERT FRENCH, M.A., M.D.Oxon., F.R.C.P. Lond. Second edition. Bristol: John Wright and Sons, Ltd. 1917. Pp. 912. Price 42*s.* net.—The first edition of this stately volume has been exhausted within five years, and whilst leaving the general character unchanged, the editor has added new articles, revised all the old ones, and nearly doubled the number of illustrations. These are not only excellently reproduced, but deal with real difficulties in diagnosis and the newer differentiating criteria which are for the most part only accessible in scattered publications. The book is, in fact, a post-graduate course for the practitioner, and should, as we said on its first appearance, materially help in the rational diagnosis of disease.

LITERARY INTELLIGENCE.—Messrs. J. W. Arrowsmith, Limited, of Bristol, have in the press a history of the Bristol Royal Infirmary, written by the late Dr. G. Munro Smith, consulting surgeon to the infirmary, and telling the story of the institution from the year 1735 to the present time. The volume contains 500 pages of text and about 50 leaves of portraits and other illustrations.

ROYAL COLLEGE OF SURGEONS OF ENGLAND.—The subjects of prizes are announced as follows:—(1) Triennial prize: "The Development of the Hip-joint and the Knee-joint of Man"; (2) Jacksonian prize, for 1917: "The Causation, Diagnosis, and Treatment of Traumatic Aneurysm, including Arterio-venous Aneurysm; for 1918: "Injuries and Diseases of the Pancreas, and their Surgical Treatment." The conditions under which the prizes are to be written for may be obtained on application to the secretary, Royal College of Surgeons, Lincoln's Inn Fields, London, W.C. 2.

THE LANCET.

LONDON: SATURDAY, MAY 5, 1917.

Toxin and Antitoxin: Tetanus Problems.

WE have taken the unusual course of devoting the whole of the original papers in this issue of THE LANCET to discussion on the best method of administering antitoxin in cases of developed tetanus. While, however, the particular question affects a relatively small number of patients—although for them it is not merely a matter of life and death but one of possible relief from torment—a careful study of the series of articles will introduce the reader to problems of general application, not alone to tetanus or even to gunshot wounds, but to the whole range of medical practice, involving such concepts as the principles of immunity and the value of evidence. It is only a few weeks since EMIL VON BEHRING passed away, and even a cursory view of his life-work reveals the fact that the discovery of antitoxin, which seemed at first sight to afford a simple solution of the treatment of bacterial disease, was but the fortunate prologue of a drama which was to become more and more intricate in the later acts. To VON BEHRING toxin and antitoxin may well have appeared as chemical antidotes capable of neutralising one another, although EHRLICH, at all events, never considered them to be simple substances of strong affinities, like caustic soda and hydrochloric acid. But toxin and antitoxin were soon found apparently capable of existing side by side, and toxin's fatal habit of combining firmly with important cells of the body, not to be called off subsequently by antitoxin, was seen to be a ruling factor in practical problems of immunity. VON BEHRING himself clearly saw the necessity of preventing toxin from combining with nerve cell, a proceeding on which the successful prophylactic treatment of tetanus in the present war has been based. Once the combination has taken place there is apparently little hope of dissociation, and all the papers which we print are directed towards the best means of preventing further toxin from reaching and fatally injuring the already damaged nerve cells. It is as though all the children in a particular district of a city had a fatal proclivity for poisoned sweets, and the municipality was discussing by what route the further supply of sweets could best be stopped, whether by patrolling the particular streets or by adding the proper antidote to the town water-supply.

Given the poisoned nerve centres and the preventive remedy, the most important single practical question is the method of bringing the latter to bear on the former. The possible routes are four: subcutaneous, intramuscular, intravenous, and intrathecal. The reader should refresh his memory of an article by Colonel Sir W. B. LEISHMAN and Major A. B. SMALLMAN, published in THE LANCET of Jan. 27th, in which 160 cases of tetanus, occurring during the first four months of the battle of the Somme, were submitted to elaborate analysis. The conclusion was then reached that the intravenous route offered the worst prospect of success, while the intrathecal route was very little better. The most successful results appeared to follow intramuscular injection. On the other hand, the War Office Committee for the Study of Tetanus has consistently advised the intrathecal route as the best, and the articles in this issue by the chairman and certain members of the Committee, by tetanus inspectors, and others, may be taken collectively as the Committee's reply to the doubts cast by Sir WILLIAM LEISHMAN and Major SMALLMAN upon the value of the intrathecal route. The evidence upon which the latter relied was essentially statistical, and the justification for their conclusions is dealt with by Captain M. GREENWOOD, who has submitted their figures to the tests commonly employed by the statistician, and who finds that the variation in case mortality from group to group was such as might easily have arisen by chance within a uniform population. Sir DAVID BRUCE in an analysis[1] of mortality figures of tetanus in this country during the first and second years of the war came to conclusions totally different from Sir WILLIAM LEISHMAN and his coadjutor. The statistician's criticisms apply with equal force to all three sets of figures. The conclusions of Major H. R. DEAN and of Major F. W. ANDREWES are based on evidence of a different kind. Both of them analyse small groups of cases coming directly under their own personal observation as inspectors, and their conclusions are also in direct opposition to those of Sir WILLIAM LEISHMAN and Major SMALLMAN, although they differ between themselves, inasmuch as Major DEAN is a strong advocate of the intravenous route, while Major ANDREWES no less strongly supports the intrathecal. Taken together it would seem that excellent results may follow the administration of antitoxin by either of these routes. There is finally presented the experimental evidence cited by Sir DAVID BRUCE on behalf of the Committee of which he is chairman. The experiments of Professor C. S. SHERRINGTON were carried out on animals closely allied to man with a care which can leave little room for cavil, and should go far to set at rest the doubts frequently expressed of the validity of reasoning from laboratory animals, such as dogs, rabbits, and guinea-pigs, to man himself. They confirm the value of the intrathecal route. Captain F. GOLLA'S experiments also emphasise the superiority of the intrathecal (and intravenous) routes over other methods.

The whole discussion is, as we have suggested, not merely of intrinsic interest, but of great value in view of the clear issues it raises on the difficulties of expert evidence. The statistician expresses doubt on the value of the analysis of clinical

[1] THE LANCET, Oct. 23rd, 1915, and Dec. 2nd, 1916.

results, alleging that the figures when examined do not admit of any clear conclusions being drawn. The clinician questions the deductions of the experimenter who deals with animal conditions not necessarily applicable to man. The experimenter cannot accept the statistician's conclusions at his own value, and queries the necessity of elaborate analysis where convincing ocular demonstration lies ready to hand. The outside observer notes with interest how long such questions as the value of the antitoxin treatment of tetanus may remain in doubt. A generation ago the late Professor KANTHACK impressed on his pupils the division of cases of tetanus into three groups: the hopeless cases with short incubation period, those long in incubating which recovered whatever the nature of the treatment, and a small intermediate group on which alone the value of treatment could be demonstrated. A year or two ago Professor SAHLI, of Berne, entered the lists as a protagonist of the value of fine statistics in contradistinction to what he termed coarse ones. He contended that a deduction based on a number, though small, of accurately observed cases was a kind of statistical method affording a much greater chance of correctness than the method of large or grouped statistics. He gave as an obvious illustration the effect of opening an abscess, remarking that in such an instance the method of coarse statistics might indeed be used but was superfluous, inasmuch as clinical observation could answer such questions at sight and therefore much more quickly and with less trouble. An inquiry into the treatment of pneumonia among South African natives published in THE LANCET of Dec. 14th, 1912, gave Sir ALMROTH WRIGHT and others occasion for a similar comment on the spheres of application of the experiential and statistical methods. Where, they say, there is a shorter and a longer way it will be well not to choose, *on principle*, the longer. In medicine, SAHLI added, that alone stood on a firm basis which had been clearly seen and experienced personally. We commend these wise sayings to our readers in their perusal of the articles in this issue.

The Health of Munition Workers.

AN interim report upon industrial efficiency and its relation to fatigue as seen among the munition workers has been presented to the Ministry of Munitions by the Health of Munition Workers Committee, over which Sir GEORGE NEWMAN presides.[1] The report bears out in every particular views that have been expressed in our columns both by correspondents and editorially, for it refers to "a pronounced and common symptom of industrial fatigue which appears to be the reflection in the workman's general health and spirits of the results of accumulated nervous fatigue rather than a direct or measurable sign of it." The report embodies a statistical study by Dr. H. M. VERNON upon output in relation to hours of work; a most valuable investigation by Professor T. LOVEDAY into the causes and conditions of lost time, in which it is suggested that insufficient allowance is generally made for the extent to which lost time is caused by sickness, partly owing to the difficulty of obtaining trustworthy medical certificates; interesting inquiries into the health of males and of females engaged in the factories, made respectively by Captain T. H. AGNEW, R.A.M.C., and by Dr. JANET CAMPBELL and Dr. LILIAN WILSON; and authoritative memoranda by the Committee upon the causes of industrial fatigue, the comparative efficiency of day work and night work, and the influence of wages as an incentive to industry. The report may be said, therefore, to take a truly comprehensive view of a widely ramifying subject, and it deserves the close attention from medical men which it will undoubtedly receive.

The Committee define fatigue as the sum of the results of activity which show themselves in a diminished capacity for doing work. Analysis of the manifestations and features of fatigue has led them to the conclusion in one of their published memoranda that the condition depends not upon the using up of the substances supplying the chemical energy liberated during work—bodily sensation being a fallacious guide—but upon the accumulation within the living elements of the products of the chemical changes involved. The problems of industrial fatigue primarily, and almost wholly, are those of nervous default owing to such accumulation. The data on which this conclusion is based have been collected by various investigators in regard to the effect upon output of employing men and women at night either on the discontinuous system, under which a worker is employed for weekly periods alternately by night and day, or on the continuous system, under which a worker is employed continually at night for a long period; and the recommendation of the Committee is that for women it is undesirable to adopt continuous night shifts in any factory, and that for men, though the evidence is not so pronounced, the advice has general application. Captain AGNEW'S study of the health of the male workers is based upon the examination of 1543 men 41 years of age and upwards and 1509 boys 18 years of age or under. In order to make his data as trustworthy as possible and capable of forming an objective basis for administrative action, Captain AGNEW classified the examinees solely upon the result of his examination of them, and without any reference to their hours of labour or conditions of work until the reports upon each factory were being compiled. He appends to his report a series of recommendations of which the most important is a reduction of excessive hours of work, especially when bad transit lengthens the working day, and in the case of boys. The general conclusion of the Committee, after what has obviously been a close and learned investigation of the problems presented in the study of industrial fatigue among the munition workers of both sexes, is that the application of scientific lessons in respect to greater efficiency is hampered by a lack of observation of the available facts, an ignoring of the teachings of science by those in authority, and a lack of endeavour to promulgate

[1] London: His Majesty's Stationery Office. 1s. 3d. net.

existing knowledge or to establish intercommunication between different firms, whereby individual experience could become common property. The Committee accordingly emphasise the need of some permanent organisation for the collection of scientific data, to be used in the solution of industrial problems. Their conclusion is justified by every word of the report, with its accompanying documents.

With one practical point, suggested by the evidence collected, the Health of Munition Workers Committee have dealt promptly. Industrial fatigue arises insidiously, and it is a matter of experience that a brief remission of work, if given in time, will prevent the condition going on to inefficiency. But in this situation both employers and employees require all the assistance that can be obtained from trustworthy medical certificates. Various witnesses called the attention of the Committee to difficulties which have arisen in regard to medical certificates put forward by munition workers in support of absences from work on account of illness. It appears that on some certificates no information is given as to the cause of illness, as to its probable duration, or as to whether immediate absence from work is essential or can be postponed until a particular job has been completed. In order to meet these difficulties the Committee have prepared a form of certificate which should, in their opinion, afford the desired information, and at the same time be easily and quickly filled in. It is suggested that in the case of national factories copies of this form of medical certificate should be supplied to panel practitioners and other medical practitioners in the neighbourhood, with a request that the form may be used for all medical certificates given to munition workers. The certificate is what it claims to be, a simple document, on which the medical practitioner certifies the diagnosis and answers questions as to the need for the immediate cessation from work and the probability of the break-off being for longer than a week. We may mention that in the absence of the coördinated scientific knowledge, deplored by the Committee, the giving of such certificates will entail a new responsibility of a delicate nature upon the medical profession.

ROYAL COLLEGE OF PHYSICIANS OF LONDON.—An ordinary Comitia was held on April 26th, Dr. Frederick Taylor, the President, being in the chair. The minutes of the Comitia held on April 2nd and of the Censors' Board were read and confirmed. Licences to practise physic were granted to 101 candidates, who, having conformed to the by-laws and regulations, had passed the required examination. The following gentlemen were elected to the Fellowship of the College:—Dr. R. H. Cole, Dr. D. N. Nabarro, Dr. H. W. Gardner, Dr. J. T. Calvert, Dr. R. H. Miller, Dr. C. F. Coombs, Dr. P. W. Saunders, Dr. W. E. Hume, Dr. H. MacCormac, Dr. C. J. Singer, and Dr. E. P. Poulton. The following resolution from the Committee of Reference was received:—

That in consequence of (1) the depletion of the staffs of the hospitals and medical schools; (2) the reduction in the number of students; (3) the amount of time necessarily devoted by students in their fourth and fifth years to practical clinical work owing to the shortage of resident medical officers—the Royal Colleges of Physicians and Surgeons be requested to consider the desirability of suspending, during the period of the war, the regulations that students should attend systematic courses of lectures.

This was referred to the Committee of Management for consideration and report. Sir Seymour Sharkey was re elected a Representative on the Senate of the University of London.

Annotations.

"Ne quid nimis."

THE PHYSICAL WELFARE OF MOTHERS AND CHILDREN.

THE two handsome volumes just issued by the Carnegie United Kingdom Trust are but a first instalment of a comprehensive report on the existing provision for promoting the physical welfare of mothers and young children, which will include Ireland as well as the whole of the United Kingdom. The first volume has been compiled by Dr. E. W. Hope, medical officer of health for Liverpool, and is based on information supplied by the sanitary staff all over the country, to whom appropriate schedules were supplied to fill in.[1] A summary of these returns fills a large part of the volume. Dr. Hope considers, and we agree with him, that the country is thoroughly awakening to the necessity for more active interest than has hitherto been taken in the care of maternity. An admirable series of charts and diagrams illustrate the saving of life achieved in recent years by intelligent and well-directed procedure. The lesson which Dr. Hope draws from the results of the inquiry, besides the need for more welfare centres and maternity homes, the latter especially in rural areas, is the importance of improved education in the various branches of the science of public health and of encouraging research into the circumstances adversely affecting infancy and motherhood. The second volume contains a careful study of the midwife by Dr. Janet M. Campbell, one of the senior medical officers of the Board of Education. Dr. Campbell states that a large proportion of midwifery practice is now in the hands of midwives and assumes that it is likely to remain there. This being so, it is urgently necessary to attract well-educated women to the study and practice of midwifery, and having attracted them to provide them with proper training and an adequate status and remuneration. This report, along with Sir Arthur Newsholme's recent report on the causes of infantile mortality, affords adequate material on which to base efficient methods of remedying acknowledged evils.

THE INCIDENCE OF INSANITY DURING THE WAR.

THE stress of the conditions of war might be expected to lead to mental breakdown, at all events in persons of unstable mentality. But so far the evidence available, which we have dealt with on several occasions,[2] has not confirmed any increase of insanity. In his recent annual report to the visiting committee of the City of London Asylum Dr. R. H. Steen returns to the question again, and finds "no evidence of any increase in insanity during the past two and a half years," adding, in fact, "it is highly probable that there has been an appreciable decrease." His own explanation of this decrease is based on the following considerations. It is generally admitted that in bad times insanity decreases, while in good times with abundance of money insanity increases. The reason for this is supposed to be found in the fact that in times of plenty there is more drunkenness, in times of want less drunkenness. In this respect the present period is exceptional, for, though the working classes have been enjoying a period of unexampled

[1] THE LANCET, 1916, ii., 28.
[2] THE LANCET, 1915, ii., 352, 771, 937; 1916, i., 369; 1917, i., 386.

prosperity, less alcoholic liquor has been consumed and the number of convictions for drunkenness has been reduced. If any increase in insanity in the country had occurred it would have been at once noticed in an increase of the admissions to the public mental hospitals. Regarding the patients themselves, Dr. Steen says that, although the daily papers circulate through the wards, and many patients take a great interest in the events recorded, the total effect is inappreciable.

An apparent exception to this general statement is now recorded from Ireland. In the sixty-fourth annual report of the Inspectors of Lunatics (Ireland) dealing with the year 1914 it was pointed out that whereas an increase in the number of admissions due to mental stress might have been expected owing to war conditions, no such increase, as a matter of fact, was shown by the figures at disposal. The percentage of the total admissions to asylums in which mental stress was assigned as a factor in the causation of insanity in 1914 was 16·9, and was practically identical with that of the two preceding years, while the percentage in which it was regarded as the principal factor was 11·4, showing a small reduction on that of the same two years. The war had, however, then only lasted five months. In the sixty-fifth report, which has now just been issued, it is shown that amongst the admissions for the complete year 1915 no less than 19·2 per cent. were attributed wholly or partially to mental stress, while in 13·3 per cent. this was assigned as the principal cause. Further analysis showed that it was possible to attribute to war conditions some direct part in the causation of over 1 per cent. of the admissions for the year, and a predominant part in 0·32 per cent., while two-thirds or more of the cases so caused were not, as might have been expected, recurrent cases, but first attacks. Women suffered more severely than civilian men from the mental effects of the war. The incidence of insanity among the fighting men is touched upon, but the figures are found insufficient to afford material for conclusions. We may well separate the two inquiries. The rôles of active participation and of passive spectator are so different that their results are hardly likely to afford useful comparison. Everyday experience suggests that the latter is the more liable to upset mental balance, and some confirmation that this is the case may be forthcoming from neutral countries.

CLEAN MILK.

THE dangers to which the community is continuously exposed by the contamination of the milk-supply are set forth in a pamphlet just issued by the National Clean Milk Society, whose avowed objects are to raise the hygienic standard of milk products and to educate the public in the importance of a clean and wholesome milk-supply. A useful form of public education is afforded by a well-executed poster illustrating the unlimited opportunities of soiling undergone by milk between the cow and the bottle-fed baby. The pamphlet contains the result of an investigation into the hygienic quality of the milk supplied to babies attending certain schools for mothers. In samples supplied by 27 dairymen to seven London schools the Lister Institute of Preventive Medicine found the colon bacillus in every case and twice the tubercle bacillus as well. Both were found in a sample of milk contained in a glass bottle stated to have been sent direct from the farm to the consumer. Such a condition of things would not be tolerated in many of the large American cities, and local authorities in this country ought to be in a position to prevent the sale of such an article of diet. The figures quoted, and other replies received in answer to questions addressed to all schools for mothers throughout Great Britain and Ireland, have led the society to draw the melancholy conclusion that for all practical purposes the subject of clean hygienic milk has been ignored in England. Pending more effective action by local authorities, the pamphlet suggests certain steps which might be taken by those responsible for the feeding of young children, including the unexpected visit to the farm at milking-time and the filling in of a "score card" for dairy farm inspection supplied by the society. The pamphlet should command attention as dealing with a vital national question, and its study will, we hope, result in a substantial increase of the membership of the National Clean Milk Society, whose address is 2, Soho-square, W. 1.

FRAGILITAS OSSIUM, BLUE SCLEROTICS, AND OTOSCLEROSIS.

UNDER the general term "fœtal rickets" were at one time placed somewhat varied types of cases which have since been clinically dissociated and are now recognised as definitely separate pathological conditions. Achondroplasia was one of these conditions, cretinism another, whilst the term osteogenesis imperfecta, or fragilitas ossium, embraced the third. The present remarks appertain mainly to the last of these groups. An instructive paper upon the subject is published in the *Edinburgh Medical Journal* (April, 1917) by Dr. E. Bronson. He records two families which presented hereditary fragility of the bones, associated with which was the presence of grey-blue sclerotics and, in the first family, otosclerosis. The first family (C——) was traced through four generations. Four features were noticeable. 1. The liability to fractures. In none were there fractures at birth; the earliest age for fracture to occur was one and a half years. Dislocations were nearly as frequent as fractures. One member had 13 fractures, though no members presented that unusual proneness to such accidents as is shown by non-familial cases. 2. Unusual prominence of the frontal and occipital bones, without the typical squareness of the rickety head. 3. Grey-blue sclerotics, due, apparently, to increased translucency rather than to decrease in thickness, was present in all cases which showed fractures and was absent in those members who failed to show this liability. 4. Progressive deafness, starting in early adult life, was present in seven individuals; the cause of this condition is not clear. The second family (T. W——), traced through three generations, presented somewhat similar features, excepting that there was no deafness and the bony changes in the head were different, showing an increase in the bitemporal diameter. To these two familial instances of fragilitas ossium are added accounts of three isolated, non-hereditary examples of the same condition. In two of these cases there were pre-natal fractures; in the third fracture occurred soon after birth. All showed grey-blue sclerotics, but less marked in character; in all there were bony changes, in one instance dwarfing, in another bony rarefaction, in a third deformity in shape of the head. The pathology of fragilitas ossium is obscure. The only known factor is heredity—by direct transmission—but

this is not always present. Syphilis plays no part in the causation. Theories only can be suggested to explain the shortness of stature in these cases; certainly it is not explainable, as in achondroplasia, by defective cartilaginous proliferation. The fractures are often painless, and union is usually rapid. The legs are most frequently involved, especially the thighs. Few metabolic or chemical observations have been made in this disease. There appears to be a deficient functional activity of the osteoblasts, whether these have to do with subperiosteal or enchondral ossification. Treatment seems of no avail. Whilst cases of fragilitas ossium of the pre-natal type present striking morbid features, especially in the bony changes in the head, the child seldom surviving, and whilst they have been classed as separate clinical entities from the type here described, the author considers that these two conditions own a common cause or pathology whether its effects be pre-natal or post-natal in their incidence. Especially suggestive evidence in support of this view is the fact that one of the cases detailed (Case 2) had fractures at birth, but survived, yet her appearance and physique so closely resembled one of the hereditary cases (family of T. W——) with later fractures that they were regarded, when shown at a medical meeting, as sisters. A critical résumé of the literature on the subject adds to the value of this interesting article.

PLACENTAL TRANSMISSION.

THE manner in which the materials necessary for its growth and repair are supplied to the fœtus and its waste products removed has always been a problem of absorbing interest. That the placenta acts as the nutritive and excretory organ of the fœtus is commonly accepted, but the proof of this is chiefly indirect. It is a subject for further investigation whether the placenta acts as a transmitter of certain substances by a process of simple diffusion, or whether it has the power of altering their chemical constitution so as to render them more readily absorbable, or the power of rejecting them altogether. The materials necessary for the growth of the fœtus must be absorbed from the maternal blood through the chorionic villi, and its waste products eliminated in the same manner. While it seems certain that some chemical substances may pass into the fœtal body by simple diffusion, it is equally certain that the chorionic villi have a selective activity and are able to choose substances required for the growth of the fœtus and even to store up in the fœtal body certain materials which are equally needed by the mother so as to cause in her body an actual shortage of these substances. Such a state of affairs may occur in cases of anæmia and osteomalacia in which apparently iron and calcium pass over to the fœtus to the detriment of the maternal tissues which are lacking in these substances. That certain bodies can pass from the maternal blood to the tissues of the fœtus has been proved in the case of the human subject, and even more conclusively in the case of animals. It may be stated further, without fear of contradiction, that the placental route is the only one by which the fœtus can be nourished. It is not possible even at the present time to assert whether any given substance passes to the fœtus by a simple process of diffusion or whether it is altered in any way in its passage through the chorionic villi. In the same way the waste products of tissue change in the fœtus may pass out of its body by simple diffusion or may be actively eliminated by the cells of the villi. A great deal of work has been and is being done on this subject. The investigation is naturally a very difficult one, and great care should be required in interpreting the results obtained. As E. D. Plass, in a recent paper in the *Johns Hopkins Hospital Bulletin*, has pointed out, according to the diffusion theory the plasmas—the fluids on the two sides of the supposedly permeable membrane—should contain the same amount of all soluble diffusible substances, whereas according to the secretory theory a difference might occur in the concentration of the same substance on the two sides of the active membrane when the need for it was greater in one organism than the other or, when its presence was actually harmful. He argues that in such investigations it is really necessary to consider the plasma of the bloods separately from the corpuscles. In a determination of the quantity of creatinine in maternal and fœtal blood he found that the amounts are practically the same, and concludes that creatinine passes between the mother and child by simple diffusion. In another investigation on the obstetrical significance of the blood sugar W. H. Morriss showed that the concentration of glucose in the maternal and fœtal blood is such that the placental interchange may be explained by the process of simple diffusion. These investigations are valuable for the light they throw upon one side of the problem, but we are still largely in the dark with regard to the selective activity which the cells of the chorionic villi undoubtedly possess. Have they, too, the power of storing up certain substances? The intra-vitam method of staining, introduced by Goldmann of Freiburg, is of great interest in this connexion; and the fact that while, in the early stages of pregnancy, the stained cells are found in the placenta and the granules of pyrrhol-blue are eagerly taken up by the fœtal cells, in the later months of pregnancy the dye cannot pass the layer of cells intervening between the fœtal and maternal tissues of the placenta is one of great interest and importance. It is to be hoped that further investigation may throw more light upon these important problems.

A PUBLIC HEALTH LABORATORY FOR NORTH WALES.

IN November last Dr. Emyr Owen Price, of Bangor, by impressing on some local medical men the advisability of starting a laboratory in the area where pathological specimens could be examined for private practitioners and sanitary authorities, laid the foundation of what is turning out a large movement. Those before whom Dr. Price placed his views having welcomed them, a medical deputation waited upon the Senate of University College, North Wales, and urged that body to give practical effect to the idea. The appeal made to the Senate indicated the functions of the proposed laboratory as follows: (1) To examine and report upon pathological material, products of disease; (2) to prepare vaccines from material supplied; and (3) to carry on research work. Sound arguments were adduced why the College should be glad to welcome the scheme. At present all such work is carried on for North Wales by commercial enterprise in London, Liverpool, and Manchester. This is clearly a waste of individual opportunities for medical research when it can be conducted in the scientific depart-

ment of a recognised medical centre. Moreover, the medical practitioners of North Wales are embarrassed by having to send pathological material to places remote from its gathering ground, and ought to be able to obtain through the College in their centre advice and assistance in the more scientific side of their professional work. These points were well brought out in the representations made to the College by the medical deputation, and as a result the Council of the College adopted cordially the idea put before them. Indeed, they went further, for not only is a bacteriological institution to form part of the new science buildings of the College, but a comprehensive public health laboratory is to be founded, and a draft scheme with this object has now been made public. From this scheme it appears that the work of the laboratory or institute, under its bacteriological or chemical sections, will be well designed to meet the needs in North Wales of medical men, sanitary authorities, agricultural bodies, and veterinary practitioners, and we wish the new enterprise every success.

SCHOOL REFORM IN THE FUTURE.

A MEMORANDUM has been issued by the Child Study Society upon the educational principles which should direct future school reform, in which the importance is pleaded of basing educational methods on sound child-psychology, paying attention to emotional, moral, and æsthetic activities. The ideal curriculum, says the memorandum, should consist largely of life-sustaining occupations with more and more intellectual studies grouped around them, instead of the education being directed towards the general training of abstract faculties. Children should at school do necessary, and therefore to them interesting, work as well as satisfy their intellectual curiosity. This need of children to be interested begins to be marked at the stage between babyhood and school-age proper—i.e., about 6–8 years of age—and specialists and psychologists are asked to devise an educational syllabus fitted to this transitional period, when individual freedom begins to clash with the self-control demanded for school-life. The recognition of the child's outlook and the introduction of topics of instruction at the moment appropriate for the cöoperation of the native instinctive impulses have in considerable measure arisen from the mutual efforts of the scholastic and medical professions, and owe much to pioneer work among defective children. The further development of the new pedagogy is mainly a task for the teacher, and will involve patient and carefully correlated experiments. The memorandum urges the promotion of research in education by the provision of the necessary facilities and financial assistance, and by the appointment of a strong Educational Research Board to assist and coördinate the work. It points out that such a board could be constituted on similar lines to the Medical Research Committee. Much individual research is actually carried out the results of which remain unknown save in local circles, while its application and value suffer from lack of facilities for discussion prior to publication. Were experimental and observational schools or classes to be established, both in their educacational and medical bearings, many problems could be considered, when results might be worked out under competent control. The problems of child-study may be essentially for the scholastic profession, but it is most desirable that the activities of the educational medical officers should not be confined entirely to questions of the health of individual children. They should embrace the wider range of educational hygiene, and we are glad to know that many of these officers are showing practical agreement with this view. Such practical child-study is essential to progress, and the results of the investigation of abnormal children in the past have been so fruitful as to promise well for the future, particularly if attention be paid not only to the phases of intellectual development but to the early stages of emotional and volitional life. Coördination of research, as well as wider spread of knowledge of results already achieved, is the great move that should now be taken. There should be opportunities for discussion and for the wide circulation of research in connexion with child-study and education. A central board, such as the memorandum desires, could not only suggest general topics, but also determine in broad outline the necessary procedure, issuing directions on lines which could be followed with a minimum expenditure of time. Uniformity of effort, which is at present wanting in official returns and reports, whether on educational progress or medical inspection, would thus be secured. So far as the strictly medical side of child-study is concerned, there is need for facilities rather than for a special staff. An allowance of even a session a week for approved research, to be carried out on previously defined lines, would enable many problems to be solved, and would give an interest and zest to an occupation which on its routine side is monotonous for many whole-time officers. The establishment of further bonds of interest and opportunities for mutual work and discussion between the doctor and the teacher would be to the advantage of both and of profit, most of all, to the child.

ACUTE PULMONARY ABSCESS TREATED BY ARTIFICIAL PNEUMOTHORAX.

IN the *Journal of the American Medical Association* recently Dr. W. D. Tewksbury has called attention to a simple and rational method of treating acute abscess of the lung. He saw in consultation a case of acute abscess of the lung following operation on the nose, and advised as a rational procedure artificial pneumothorax, although its use had previously been confined to pulmonary tuberculosis, excepting a few cases of chronic pulmonary abscess and one case of interlobar empyema. The patient was a mining engineer, aged 32 years, who about the middle of June, 1916, was injured in an elevator, sustaining fracture of the superior maxilla and nose. An operation for repair of the nasal septum was performed on June 17th. He was apparently doing well until June 26th, when his temperature rose above 101° F., with pain in the chest and sweating. Pleurisy with a little effusion at the left base was found. The temperature remained high until July 12th, when he suddenly coughed up much purulent sputum, and a radiogram showed an abscess in the lower part of the right lung. After this the temperature remained about 102°, he lost weight, and sweated profusely at times. On July 22nd Dr. Tewksbury was called in consultation to consider the possibility of using compression of the lung. He advised waiting a little, both because the operation would be somewhat of an experiment and because of the pleurisy with effusion on the opposite side. The patient con-

tinued to expectorate much, lost weight, sweated profusely at times, and the temperature and leucocyte count remained high. On August 12th Dr. Tewksbury injected 150 c.c. of air into the pleural cavity, on the 14th gave another small injection, and on the 22nd a larger one, following which the temperature became normal. Injections were then given about once a week, making 10 in all. By Sept. 15th all cough and expectoration had ceased. The patient gained 20 lb. in weight and was discharged cured on Oct. 15th. The only unpleasant symptom caused by the injections was some dyspnœa and cyanosis on one occasion following an unusually large injection. In a second case a woman, aged 27, had acute abscess of the lung following tonsillectomy. There was much foul purulent expectoration. A radiogram showed a large abscess involving most of the upper and some of the lower lobes of the left lung. As she was extremely prostrated, Dr. Tewksbury was not at all optimistic when, four weeks after the onset, he started to collapse the lung. However, the temperature, pulse, and cough improved on the following day, and two days later he gave a second injection. That night she coughed up an unusually large amount of pus, and on the following day the temperature was normal, and it remained so thereafter. The possible value of this treatment is shown by the following considerations. The mortality of acute abscess of the lung treated medically is about 60 per cent., and the percentage of cures is only about 10. The results of rib resection and drainage are better, but the mortality is about 30 per cent. Moreover, this operation often leaves a sinus which may persist for a year or more. Artificial pneumothorax is, of course, applicable only in cases in which the abscess communicates with a bronchus. In an annotation in THE LANCET of Nov. 20th, 1915, we described a case of *chronic* pulmonary abscess—recorded by French writers—in which this treatment was successful.

WE regret to record the death in the Near East of Sir Armand Ruffer, C.M.G., president of the Sanitary Maritime Council of Egypt.

THE Annual Oration to the Medical Society of London will be given at 11, Chandos-street, Cavendish-square, W. 1, at 9 P.M., on Monday, May 14th, by Sir William Osler, F.R.S., his subject being "The Anti-Venereal Campaign."

MEDICINE AND THE LAW.

R. v. *Caley: Successful Appeal.*

THE Court of Criminal Appeal has allowed the appeal of Mr. W. B. Caley from a conviction at the Central Criminal Court upon charges of conspiring to defeat the provisions of the Military Service Acts and of contravening the Prevention of Corruption Act, 1906, upon which the appellant was sentenced recently by Mr. Justice Coleridge to 18 months' imprisonment in the second division. The case will be remembered as the "White City Case," the facts of which, as proved at the police court and at the Old Bailey, were widely reported at the time. The Lord Chief Justice, who delivered the judgment of the Court of Criminal Appeal, said that the main point for consideration was whether, when the case was viewed as a whole, there was sufficient evidence to support the verdict of guilty. There had been proof of a conspiracy, but the difficulty of the Crown had lain in proving that Mr. Caley had been a party to it. There was no evidence that he had received any of the money which had been taken by Mitchell, who was convicted at the same time as the appellant, and of which the other prisoners had had their share. Equally there was no evidence to prove that Mr. Caley knew that any of the reports or certificates given by him were false. Such evidence as there was, was, in fact, equally consistent with the appellant's innocence or guilt. The charges were in respect of five cases, in two of which Mr. Caley never classified the men at all. It had been argued that he made a report with regard to them which had been acted upon, but one of these two men was admitted to have been unfit for service through lameness, and Captain Cooper, who was stated to have acted upon the reports in question, was not called as a witness, though the prosecution had been challenged to call him. There was no evidence, therefore, that Captain Cooper relied on Mr. Caley's report, and if he did so there was no evidence that Mr. Caley had wilfully made a false report. Out of three other cases two had reference to detectives. In the third the Lord Chief Justice pointed out that even though the appellant had classified the man as B 3, and he had afterwards been re-examined and put in Class A, this was equally consistent with innocence and with guilt. One of the two detectives was passed for general service, the other was rejected as suffering from chronic synovitis and had admittedly suffered in the past from that disease. There was also evidence that he had complained of pain at the time of his examination. This man had paid money to Mitchell, but no part of it had passed to the appellant. The evidence in the case was not satisfactory, and the conviction upon it of the appellant could not stand. The conviction accordingly was ordered to be quashed.

Liability of a Husband for Medical Attendance on His Wife.

A correspondent has called attention to a case decided by the Divisional Court in February, to which we did not allude at the time, as it did not, on the surface, involve any new principle affecting the medical profession. We refer to it now as our correspondent describes it as resulting in "a bad position both for women and children who are left in England as well as for a doctor." He also observes rightly that "if the decision applies to doctors the law must apply to everybody who has given credit." The appeal was against a judgment of a deputy county-court judge sitting in the Brompton county court, in a case (Travers *v.* Sen) in which a medical man sued a married lady for the balance of his account for attending her in her confinement. The defendant had paid £25 and refused to pay more. At the close of the plaintiff's case counsel for the defendant submitted that there must be judgment for her on the authority of cases which he cited, as the action should have been brought against the defendant's husband and not against her personally. This contention was accepted by the deputy judge, and the judgment appealed against was entered for the defendant. The hardship involved in this for the medical man, of which our correspondent complains, lay in the fact that the husband of the defendant was in Rangoon and not easily to be proceeded against. The principle upon which the decision was based, that a wife has an implied authority to pledge her husband's credit for necessaries, which would include the services of a medical man in her confinement, is no new one, but the point was discussed at the hearing and in the Divisional Court as to how far the absence of the husband, separated from his wife by the accident of his employment, affected his liability. In the Divisional Court, however, the dismissal of the plaintiff's appeal was not so much in consequence of the acceptance by the judges of the principle of law as upon a point of fact. Mr. Justice Atkin, in delivering his judgment, pointed out that the plaintiff had attended the defendant on previous occasions and had been paid by the husband. Letters also had passed between the plaintiff and the defendant and the husband in Rangoon, upon the present occasion, which indicated that the husband did not repudiate the charge but merely complained of its amount. There was, his lordship observed, plain evidence that the husband looked upon himself as liable, and the deputy judge was quite entitled to conclude that the defendant was contracting only as agent for her husband. Mr. Justice Bailhache concurred in this judgment, but he also discussed the question of whether the separation of husband and wife did away with the wife's authority to pledge her husband's credit, and expressed the view that a distinction existed between an intentional suspension of marital relations and the case before him, in which the absence of the husband from the wife was due only to the accident of his calling. He pointed out that the nature of the contract made must

be considered, and added, with regard to the case at issue, that there could hardly be a contract in which it could more reasonably be inferred that the liability was on the husband than an arrangement for medical attendance on the wife at the birth of her husband's child.

In comment on the above, and in view of our correspondent's complaint that the decision is a hard one for wives and children seeking medical aid in the absence of the husband abroad, and also for medical practitioners who may attend upon such, it may be pointed out, that in a large majority of cases the medical man, or any creditor, suing on a contract for necessaries supplied to the wife, has a better chance of obtaining the money from the husband than from her. It would be much harder on the medical man, in ordinary circumstances, if the law were such that he could not make the husband pay for attendance on the wife.

THE RADIUM INSTITUTE, LONDON.

THE report of Mr. A. E. Hayward Pinch, F.R.C.S., on the work carried on at the Radium Institute (Riding House-street, Portland-place, London, W. 1) over a period of two years, from Jan. 1st, 1915, to Dec. 31st, 1916, is an interesting document. A summary is given of the treatment of a large variety of morbid conditions, including carcinoma, rodent ulcer, sarcoma, lymphadenoma, mediastinal tumour, fibroid disease of the uterus, papilloma of the bladder, lupus vulgaris, nævus, cutaneous papilloma, lupus and other skin affections, as well as general diseases. The total cases dealt with numbered 1400, to whom 12,331 separate treatments were administered (more than 8000 of these free of charge to necessitous patients). Of these, 87 were examined but not treated, 123 were treated too recently to record results, and 33 received prophylactic irradiation only. Of the remaining 1157 cases, 172 were "apparently cured," 52 were "cured," 498 "improved," 215 "not improved," while 144 abandoned treatment, and 76 were dead. The Institute has rigidly adhered to a policy of declining to treat operable cases of malignant disease—rodent ulcer alone excepted—unless the patient has refused to submit to operation. Apart from this the cases treated were not selected, refusal to treat being based only on the grounds (1) that the patient was practically moribund, or (2) that radium treatment was clearly unsuitable.

We print the conclusions arrived at as to the value of radium treatment in two relatively common affections as a sample of the way in which the clinical material is dealt with by the Institute.

Rodent ulcer (186 cases).—This is of all forms of malignant disease the one which is most amenable to the action of radium. Lesions which have not been subjected to any previous treatment with X rays, CO_2, snow, ionisation, &c., which do not affect mucous membrane, bone or cartilage, and do not exceed 3 cm. in diameter, can almost invariably be cured by one treatment. A full-strength applicator is used unscreened, and an exposure of between one and a half and three hours' duration given, the length of exposure being determined by the amount of induration and infiltration present. The reaction which follows upon this procedure is usually severe, but the resultant scar is smooth, supple, and inconspicuous, and the tendency to recurrence extremely slight. When the extent, position, or character of the ulcer preclude the possibility of strong unscreened exposures, the best results will probably be attained by prolonged exposures with heavily screened apparatus. The much thickened and indurated edges so often met with in cases of very long standing respond very satisfactorily to the action of powerful emanation tubes screened with 0·4 mm. of platinum and buried in the thickened border for from 12 to 18 hours.

Fibroid disease of the uterus (7 cases).—Satisfactory results are often observed to follow upon the radium treatment of this disease, more especially when menorrhagia and metrorrhagia are the most prominent and troublesome symptoms. When all ordinary methods of treatment have failed and the patient declines to submit to operation radium therapy is well worthy of trial, as it will almost certainly lessen or abolish the excessive loss of blood, and will, in addition, sometimes produce considerable diminution in the size of the uterus. Treatment is best carried out by the introduction of a tube containing 100 mgr. screened with .2 mm. of lead into the body of the uterus—or if this be impracticable, into the posterior fornix—supplemented by a plate of from 80 to 100 mgr. screened in similar fashion, and applied on the abdominal wall above the fundus uteri. The total exposure should be not less than 30 hours' duration, and the series should be repeated after two or three months. The period immediately succeeding the radium application is often more profuse than usual; then the metrorrhagia is checked, and this is followed by a progressive decrease of the menorrhagia, until the flow becomes normal: or, as is sometimes seen in very susceptible subjects, amenorrhœa occurs, and persists for four, six, or more months.

Mr. Pinch informs us that with increasing experience and with the use of larger quantities of radium the results obtained are now distinctly more encouraging than at first. He acknowledges his indebtedness to Dr. J. E. A. Lynham, who has been for two years solely responsible for the conduct of the night clinic. A note on the chemico-physical laboratory of the Institute by the director, Mr. W. L. S. Alton, F.I.C., is appended. Copies of the report will be given to any medical man on application to the secretary of the Institute.

URBAN VITAL STATISTICS.

(Week ended April 21st, 1917.)

English and Welsh Towns.—In the 96 English and Welsh towns, with an aggregate civil population estimated at nearly 17,000,000 persons, the annual rate of mortality was 18·4, against 17·3 and 18·5 per 1000 in the two preceding weeks. In London, with a population exceeding 4,000,000 persons, the death-rate was 19·4, or 0·1 per 1000 below that recorded in the previous week; among the remaining towns the rates ranged from 7·8 in Hornsey, 8·3 in Aberdare, and 8·7 in Wallasey, to 28·1 in South Shields, 28·7 in Wakefield, and 36·6 in Dudley. The principal epidemic diseases caused 489 deaths, which corresponded to an annual rate of 1·5 per 1000, and included 310 from measles, 66 from whooping-cough, 53 from infantile diarrhœa, 42 from diphtheria, 12 from scarlet fever, and 6 from enteric fever. The deaths from measles showed a slight decrease as compared with the number in the preceding week, and caused the highest annual death-rates of 3·4 in Oldham, 3·5 in Southend-on-Sea 3·7 in Salford, 4·3 in Bolton and Sunderland, 6·2 in South Shields, and 8·4 in Dudley. The 730 cases of scarlet fever and the 1296 cases of diphtheria under treatment in the Metropolitan Asylums Hospital and the London Fever Hospital were respectively 8 above and 21 below the numbers at the end of the preceding week. Of the 5973 deaths from all causes in the 96 towns, 193 resulted from violence. The causes of 54 of the total deaths were uncertified, and included 10 in Liverpool, 9 in Birmingham, and 6 in Preston.

Scotch Towns.—In the 16 largest Scotch towns, with an aggregate population estimated at nearly 2,500,000 persons, the annual death-rate was equal to 18·1, against 16·9 and 19·1 per 1000 in the two preceding weeks. The 411 deaths in Glasgow corresponded to an annual rate of 19·2 per 1000, and included 29 from whooping-cough, 28 from measles, 3 from diphtheria, and 1 from scarlet fever. The 136 deaths in Edinburgh were equal to a rate of 21·4 per 1000, and included 14 from measles, 13 from whooping-cough, 3 from diphtheria, and 1 from scarlet fever.

Irish Towns.—The 200 deaths in Dublin were equal to a rate of 26·1, or 0·7 per 1000 less than that recorded in the previous week, and included 13 from measles, 2 from whooping-cough, and 2 from infantile diarrhœa. The 172 deaths in Belfast corresponded to an annual rate of 22·8 per 1000, and included 4 from measles, 3 from enteric fever, 2 from infantile diarrhœa, and 1 each from scarlet fever and diphtheria.

(Week ended April 28th, 1917.)

English and Welsh Towns.—In the 96 English and Welsh towns, with an aggregate civil population estimated at nearly 17,000,000, the annual rate of mortality was 16·7, against 18·5 and 18·4 per 1000 in the two preceding weeks. In London, with a population exceeding 4,000,000 persons, the death-rate was 16·8, or 2·6 per 1000 below that recorded in the previous week; among the remaining towns the rates ranged from 6·4 in Ealing, 9·1 in Southend-on-Sea, and 9·2 in Ilford and Reading to 23·5 in Southport, 24·6 in Lincoln, and 27·6 in Gateshead. The principal epidemic diseases caused 433 deaths, which corresponded to an annual rate of 1·3 per 1000, and included 267 from measles, 57 from whooping-cough, 59 from infantile diarrhœa, 34 from diphtheria, 9 from enteric fever, and 7 from scarlet fever. The deaths from measles showed an increase of 43 from the number in the preceding week, and caused the highest annual death-rates of 2·7 in Middlesbrough, 2·8 in Southend-on-Sea, 2·9 in Salford, 3·1 in West Bromwich, and 4·3 in Bolton. The 720 cases of scarlet fever and 1212 of diphtheria under treatment in the Metropolitan Asylums Hospitals and the London Fever Hospital were respectively 10 below and 84 below the numbers at the end of the preceding week. Of the 5449 deaths from all causes in the 96 towns, 178 resulted from violence. The causes of 37 of the deaths were uncertified, and included 7 in Liverpool, 5 in Birmingham, and 3 in Gateshead.

Scotch Towns.—In the 16 largest Scotch towns, with an aggregate population estimated at nearly 2,500,000 persons, the annual death-rate was equal to 18·4, against 19·1 and 18·1 in the two preceding weeks. The 421 deaths in Glasgow corresponded to an annual rate of 19·7 per 1000, and included 38 from whooping-cough, 37 from measles, and 2 each from enteric fever, diphtheria, and infantile diarrhœa. The 122 deaths in Edinburgh were equal to an annual rate of 19·2 per 1000, and included 18 from measles, 9 from whooping-cough, and 1 each from diphtheria and infantile diarrhœa.

Irish Towns.—The 154 deaths in Dublin were equal to a rate of 20·4 or 5·7 per 1000 below that recorded in the previous week, and included 7 from measles, 4 from infantile diarrhœa, 1 from whooping-cough, and 1 from diphtheria. The 153 deaths in Belfast corresponded to an annual rate of 20·3 per 1000, and included 6 from infantile diarrhœa, 3 from measles, 3 from whooping cough, and 1 from enteric fever.

VITAL STATISTICS OF LONDON DURING MARCH, 1917.

In the accompanying table will be found summarised complete statistics relating to sickness and mortality in the City of London and in each of the metropolitan boroughs. With regard to the notified cases of infectious diseases, it appears that the number of persons reported to be suffering from one or other of the ten diseases specified in the table was equal to an annual rate of 4·4 per 1000 of the population, estimated at 4,310,030 persons; in the three preceding months the rates were 3·9, 4·0, and 4·2 per 1000 respectively. The lowest rates in March were recorded in Kensington, Hammersmith, the City of Westminster, Stoke Newington, and Wandsworth; and the highest rates in St. Pancras, Bethnal Green, Southwark, Bermondsey, and Deptford. The prevalence of scarlet fever showed a slight decline from that recorded in the preceding month; this disease was proportionally most prevalent in St. Marylebone, St. Pancras, Finsbury, the City of London, Bethnal Green, Stepney, Camberwell, and Lewisham. The Metropolitan Asylums Hospitals contained 785 scarlet fever patients

ANALYSIS OF SICKNESS AND MORTALITY STATISTICS IN LONDON DURING MARCH, 1917.

(Specially compiled for THE LANCET.)

CITIES AND BOROUGHS.	Estimated civil population, 1915.	Notified Cases of Infectious Disease.											Deaths from Principal Infectious Diseases.									
		Small-pox.	Scarlet fever.	Diphtheria.*	Typhus fever.	Enteric fever.	Other continued fevers.	Puerperal fever.	Erysipelas.	Cerebro-spinal meningitis.	Poliomyelitis.	Total.	Annual rate per 1000 persons living.	Small-pox.	Measles.	Scarlet fever.	Diphtheria.*	Whooping-cough.	Enteric fever.	Diarrhœa and enteritis (under 2 years).	Total.	Annual rate per 1000 persons living.	Deaths from all causes.	Death-rate per 1000 living.
LONDON	**4,310,030**	—	**425**	**660**	—	**39**	—	**22**	**240**	**58**	**5**	**1449**	**4·4**	—	**340**	**7**	**56**	**38**	**3**	**67**	**511**	**1·5**	**6042**	**18·2**
West Districts:																								
Paddington	131,397	—	10	11	—	—	—	1	8	2	—	32	3·2	—	11	—	3	4	—	5	23	2·3	200	19·8
Kensington	155,795	—	10	17	—	—	—	—	6	3	—	36	3·0	—	7	—	1	2	—	2	12	1·0	197	16·5
Hammersmith	118,559	—	13	6	—	—	—	—	6	1	1	27	3·0	—	2	—	—	—	—	—	2	0·2	154	16·9
Fulham	151,161	—	16	21	—	—	—	1	7	4	—	49	4·2	—	24	—	—	2	—	6	32	2·8	212	18·3
Chelsea	58,421	—	4	6	—	2	—	—	2	1	—	15	3·3	—	1	—	—	—	—	2	3	0·7	104	23·2
City of Westminster	135,104	—	10	14	—	—	—	1	5	2	—	32	3·1	—	11	1	—	1	—	2	15	1·4	197	19·0
North Districts:																								
St. Marylebone	100,260	—	15	16	—	—	—	—	9	1	—	41	5·3	—	37	—	—	3	—	3	43	0·6	156	20·3
Hampstead	81,760	—	5	13	—	—	—	—	3	2	—	23	3·7	—	1	—	—	—	—	—	1	0·2	74	11·8
St. Pancras	200,322	—	24	44	—	1	—	1	14	1	—	85	5·5	—	27	1	2	1	—	4	35	2·3	313	20·4
Islington	316,242	—	34	46	—	2	—	3	20	3	—	108	4·5	—	18	—	3	3	—	8	32	1·3	460	19·0
Stoke Newington	50,527	—	1	6	—	—	—	—	2	—	—	9	2·3	—	—	—	—	—	—	—	—	—	70	18·1
Hackney	217,883	—	15	30	—	1	—	3	16	4	—	69	4·1	—	—	—	1	1	—	—	2	0·1	292	17·5
Central Districts:																								
Holborn	40,405	—	3	6	—	1	—	—	1	—	—	11	3·5	—	6	—	—	—	—	1	7	2·3	55	17·7
Finsbury	76,915	—	11	13	—	—	—	1	6	—	—	31	5·3	—	1	—	1	1	1	2	6	1·0	110	18·6
City of London	19,461	—	5	1	—	—	—	—	—	—	—	6	4·0	—	—	—	—	—	—	—	—	—	19	12·7
East Districts:																								
Shoreditch	103,627	—	8	24	—	1	—	—	5	2	—	40	5·0	—	—	—	5	1	—	2	8	1·0	141	17·7
Bethnal Green	120,207	—	20	24	—	2	—	—	7	1	—	54	5·9	—	8	—	3	1	—	1	13	1·4	151	16·4
Stepney	265,731	—	34	48	—	7	—	—	15	—	1	105	5·2	—	10	1	5	2	—	3	21	1·0	345	16·9
Poplar	156,247	—	10	32	—	7	—	1	12	—	—	62	5·2	—	11	—	4	—	—	5	20	1·7	250	20·9
South Districts:																								
Southwark	179,424	—	19	41	—	1	—	2	19	5	—	87	6·3	—	12	1	3	5	—	4	25	1·8	304	22·1
Bermondsey	117,188	—	7	39	—	1	—	—	7	1	—	55	6·1	—	17	—	2	2	—	1	22	2·4	212	23·6
Lambeth	284,188	—	23	55	—	2	—	5	8	5	—	98	4·5	—	25	1	11	1	—	2	40	1·8	413	18·9
Battersea	161,945	—	14	16	—	1	—	—	10	4	—	45	3·6	—	29	1	—	1	—	2	33	2·7	219	17·6
Wandsworth	312,249	—	31	18	—	—	—	1	10	4	1	65	2·7	—	51	1	1	4	1	3	61	2·5	426	17·8
Camberwell	254,385	—	32	33	—	3	—	1	15	7	1	92	4·7	—	16	—	3	3	—	4	26	1·3	330	16·9
Deptford	110,299	—	9	24	—	1	—	—	14	3	—	51	6·0	—	1	—	1	—	—	1	3	0·4	149	17·6
Greenwich	96,385	—	7	19	—	2	—	—	2	1	—	31	4·2	—	8	—	5	—	—	—	13	1·8	168	22·7
Lewisham	164,438	—	22	15	—	2	—	1	7	1	—	48	3·9	—	1	—	2	—	—	3	6	0·5	163	12·9
Woolwich	129,505	—	13	22	—	2	—	—	4	—	1	42	4·2	—	5	—	—	—	1	1	7	0·7	158	15·8
Port of London	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Including membranous croup.

at the end of March, against 800 and 811 at the end of the two preceding months; the weekly admissions averaged 102, against 95 and 111 in the two preceding months. Diphtheria was rather more prevalent than it had been in other recent months; among the various metropolitan boroughs the greatest proportional prevalence of this disease was recorded in St. Pancras, Shoreditch, Bethnal Green, Poplar, Southwark, Bermondsey, Lambeth, and Deptford. The number of patients under treatment for diphtheria in the Metropolitan Asylums Hospitals at the end of March was 1367, against 1420 and 1453 at the end of the two preceding months; the weekly admissions averaged 161, against 168 and 165 in the two preceding months. Enteric fever also was rather more prevalent than in the three preceding months; of the 39 cases notified during the month, 7 belonged to Stepney, 7 to Poplar, 3 to Camberwell, and 2 each to Chelsea, Islington, Bethnal Green, Lambeth, Greenwich, Lewisham, and Woolwich. There were 29 cases of enteric fever in the Metropolitan Asylums Hospitals at the end of March, against 35 and 29 at the end of the two preceding months; the weekly admissions averaged 6, against 6 and 4 in the two preceding months. Erysipelas was proportionally most prevalent in St. Marylebone, Finsbury, Poplar, Southwark, and Deptford. The 58 cases of cerebro-spinal meningitis included 7 in Camberwell, 5 in Southwark, 5 in Lambeth, and 4 each in Fulham, Hackney, Battersea, and Wandsworth; the 5 cases of poliomyelitis belonged respectively to Hammersmith, Stepney, Wandsworth, Camberwell, and Woolwich. The 22 cases of puerperal fever notified during the month included 5 in Lambeth, 3 in Islington, 3 in Hackney, and 2 in Southwark.

The mortality statistics relate to the deaths of persons actually belonging to the several metropolitan boroughs, the deaths occurring in institutions having been distributed among the several boroughs in which the deceased persons had previously resided. During the four weeks ending March 31st the deaths of 6042 London residents were registered, equal to an annual rate of 18·3 per 1000; in the three preceding months the rates were 22·6, 18·4, and 21·3 per 1000. The death-rates in March ranged from 11·8 in Hampstead, 12·7 in the City of London, 12·9 in Lewisham, 15·8 in Woolwich, 16·4 in Bethnal Green, and 16·5 in Kensington, to 20·3 in St. Marylebone, 20·4 in St. Pancras, 20·9 in Poplar, 22·1 in Southwark, 22·7 in Greenwich, 23·2 in Chelsea, and 23·6 in Bermondsey. The 6042 deaths from all causes included 511 which were referred to the principal infectious diseases; of these, 340 resulted from measles, 7 from scarlet fever, 56 from diphtheria, 38 from whooping-cough, 3 from enteric fever, and 67 from diarrhœa and enteritis among children under 2 years of age. No death from any of these diseases was recorded during the month in the City of London or in Stoke Newington; among the other boroughs they caused the lowest death-rates in Hammersmith, Hampstead, Hackney, and Deptford and the highest rates in Paddington, Fulham, St. Pancras, Holborn, Bermondsey, Battersea, and Wandsworth. The 340 deaths from measles were 127 in excess of the corrected average number in the corresponding period of the five preceding years; this disease was proportionally most fatal in Fulham, St. Marylebone, Holborn, Bermondsey, Battersea, and Wandsworth. The 7 fatal cases of scarlet fever were 11 below the corrected average number, and belonged respectively to the City of Westminster, St. Pancras, Stepney, Southwark, Lambeth, Battersea, and Wandsworth. The 56 deaths from diphtheria exceeded by 10 the corrected average number; this disease showed the highest proportional mortality in Paddington, Shoreditch, Bethnal Green, Poplar, Lambeth, and Greenwich. The 38 deaths from whooping-cough were 85 below the corrected average, the highest death-rates being recorded in Paddington, St. Marylebone, and Southwark. The 3 fatal cases of enteric fever were equal to half the corrected average, and belonged respectively to Finsbury, Wandsworth, and Woolwich. The 67 deaths from diarrhœa and enteritis among children under 2 years of age were 18 below the corrected average; the mortality from this cause was proportionally greatest in Paddington, Fulham, St. Marylebone, Poplar, and Southwark. In conclusion, it may be stated that the aggregate mortality in London during March from these principal infectious diseases was 4·1 per cent. above the average.

THE death is announced of Mr. Arthur James, who, in addition to his other charitable actions, gave the income of £20 000 to the Middlesex Hospital for the purpose of cancer research.

CENTRAL MIDWIVES BOARD.—A special meeting of the Central Midwives Board was held at Queen Anne's Gate Buildings, Westminster, on April 20th, with Sir Francis H. Champneys in the chair. A number of midwives were struck off the Roll, the following charges, amongst others, having been brought forward:—

Being in attendance at a confinement and the patient suffering from excessive bleeding, the midwife did not immediately explain that the case was one in which the attendance of a registered medical practitioner was required, as provided by Rule E. 20 (3) Old Rules, and E. 20 and 21 (3) New Rules, and the patient being in the condition aforesaid the midwife did not hand to the husband or the nearest relative or friend present the form of sending for medical help, properly filled up and signed by her, in order that this might be immediately forwarded to the medical practitioner, as required by Rule E. 19 Old Rules, and E. 20 New Rules. The midwife did not take and record the pulse and temperature of her patients at each visit as required by Rule E. 14, did not enter her records of pulse and temperature in a note-book or on a chart carefully preserved as required by Rule E. 14, and she did not keep her register of cases as required by Rule E. 24. Not being scrupulously clean in every way, as required by Rule E. 2 and when called to a confinement the midwife did not take with her the appliances and antiseptics as required by Rule E. 3. In contravention of Rule E. 18 a midwife laid out the dead body of a person not being a patient upon whom she had been in attendance at the time of death, and having laid out such dead body for burial she failed to notify the local supervising authority thereof as required by Rule E. 22 (1) (d), and failed to undergo adequate cleansing and disinfection to the satisfaction of the local supervising authority, as required by Rule E 18 and 6. The midwife neglecting to cleanse the eyelids of a child at birth, as required by Rule E. 16. When attending a patient the midwife did not on each occasion wear a clean dress of washable material as required by Rule E. 2, and was not scrupulously clean in every way, as required by Rule E. 1

Correspondence.

"Audi alteram partem."

TUBERCULOSIS AND THE WAR.

To the Editor of THE LANCET.

SIR,—I agree with Dr. H. A. Ellis in protesting against the use of the term "permanently cured" as applied to pulmonary tuberculosis. "Arrested" is, I think, the proper term, as there is always the danger of a lowered vitality causing the reappearance of all symptoms. One of the big curses of pension committees to-day is the question of those known treated consumptives who have been taken into the Army during the past 30 months under the medical delusion that they had either no disease or were "permanently cured."

I am afraid that the same danger is present to-day. In the re-examination of exempted men there is the danger of these broken-down men being re-netted. The examination will not be made by tuberculosis specialists, but by all-round men. I wish to emphasise that no old consumptive case should be enlisted. Looking over a register of nearly 4000 cases, I find that of the many enlisted, practically all have returned with breakdowns, sometimes after Gallipoli and years in France, but broken-down and requiring treatment. It is false economy to take these men. They can often carry on at their own automatic work, and even if they keep up until sent on active service, then T. bacilli reappear in their sputum when they cannot carry out preventive measures and they become a danger to the others in the hut, billet, or sleeping place.

Army Council Instructions (No. 908 of 1916) state that every recruit must be asked: (1) Whether he has been in a sanatorium; and (2) whether he has been notified to any health authority as tuberculous. If his answer in the affirmative is confirmed he should be rejected. I think that every tuberculosis officer should see that this Order is carried out in deed in his district.

I am, Sir, yours faithfully,

Swansea, April 17th, 1917. FRANK CLIFFORD.

To the Editor of THE LANCET.

SIR,—The letter of Dr. Henry A. Ellis appearing in your issue of April 14th gives abundant confirmation of my contention that a tuberculosis dispensary may act as a very efficient sieve for preventing the treatment of pulmonary tuberculosis until it has become chronic. His letter reminds me of nothing so much as the directions given to a dispenser when making up a mixture containing two incompatibles, he is directed to place the incompatibles as far from one another as possible. At the beginning of his letter he seems to infer that it is impossible to cure pulmonary tuberculosis permanently, and at the end he tells us that cases suitable for sanatorium treatment are those where "the lesion has usually become more definite and permanent tissue destruction has occurred, as is demonstrated by the physical signs of the grosser nature, easily recognised by the ordinary stethoscope." Herein lies the whole crux of the problem. Why are such patients allowed to continue their work and visit dispensaries, when they should be in bed at home under the care of their own doctor, a course which would undoubtedly be the most efficient means of preventing destruction of lung, and if they do not improve rapidly they should be sent forthwith to a properly conducted sanatorium without running the risk of attending a dispensary. The necessity of the treatment or otherwise of early cases by rest in bed or at a sanatorium depends upon the occurrence or not of symptoms indicative of active disease, apart altogether from the presence or absence of physical signs.

I do not understand in what way the cases of the two soldiers mentioned by Dr. Ellis are relevant in this connexion; nor do I see any reason, as they appear to be permanently cured, why they should receive any treatment either at a sanatorium or at a dispensary. I would suggest that they return to ordinary civil life. I have had two similar cases of men returned from the front, neither of which has been treated at a sanatorium or dispensary. They were cured before being discharged from the Army, having had the good luck to be put to bed during an acute attack, in which, fortunately for them, tubercle bacilli were found in their sputum in France. But for this timely accident their illness would no doubt have been called trench fever, and they would have run the risk of acquiring that sufficient amount of destruction of lung which appears to make patients eligible for treatment in a sanatorium.

It should be known by all medical men, now, that the making of a chronic follows surely from allowing cases with low degrees of activity to continue to walk about and work when they should be in bed. No one suggests that patients with any other serious disease should continue to be wage-earners. One can no more tell whether a person is permanently cured of tuberculosis than one can state that an apparently healthy person will not develop tuberculosis. Unfortunately, owing to our present methods, we know that a good many cases returned as well and working in sanatorium reports are not cured, largely owing to delay in diagnosis, with the consequent absence of efficient treatment, which is considered unnecessary until either tubercle bacilli are found in the sputum or gross lesions are discernible by means of the stethoscope.

I am, Sir, yours faithfully,

Ayrshire Sanatorium, April 15th, 1917. EDWARD E. PREST.

THE TECHNIQUE OF LUMBAR PUNCTURE.

To the Editor of THE LANCET.

SIR,—In reference to the remarks on this subject by Dr. T. J. Horder in your issue of April 28th, I would remark that when it is supposed that the needle is blocked by a constituent of the cauda equina or other tissue, besides pushing in and withdrawing the needle a little, the further device of revolving it on its own axis is often successful. This is only what might be expected, as the aperture at the point opens more or less sideways according to the angle at which the point is made. When, again, a long needle is used for a small patient and it droops by its own weight after entering the pia-arachnoid space, a flow may frequently be established by supporting the head of the needle and so preventing the hole at the point pressing against tissue and being blocked.

In reference to being in the position of wanting a specimen free of blood, and having been unlucky enough to prick a vein, I have found it often succeed to puncture in another space. It should be remembered that it is equally safe to puncture in the second and third lumbar spaces as well as in the fourth. This manœuvre is also useful when a dry puncture unaccountably occurs and the devices recommended have failed. Again, in the cadaver, when there is no flow and a specimen is required, it is useful to insert two needles, one in the fifth or fourth space, and the other as high up as the first space if entry is possible, and then pass normal saline through from one to the other.

The following contretemps has occurred to me three times, twice in young patients and once in an adult. The needle has progressed forwards much farther than usual through soft tissue beyond the spinal cavity, a flow only being obtained by withdrawing, say one-third to half an inch. I have accounted for it by supposing that the needle has punctured an intervertebral disc, or that the back wall has been abnormally deficient. Perhaps Dr. Horder or others would give us any similar experience they may have encountered? I am, Sir, yours faithfully,

Ingatestone, April 29th, 1917. SHEFFIELD NEAVE.

THE LUMLEIAN LECTURES ON HEART DISEASE.

To the Editor of THE LANCET.

SIR,—The infective aspect of much of heart disease is of such great importance that it would seem right that the State should establish clinics all over the country to deal with rheumatism and its congeners. This would enable, by giving facilities for early diagnosis by trained physicians, much of the mental and physical loss to the country owing to such infections to be saved, and would also serve as a means of impressing on the general medical practitioner the importance of careful and early diagnosis of such nationally harmful conditions as would be dealt with in such clinics as I have suggested. Dr. F. J. Poynton's letter in THE LANCET

of April 14th should be read and digested and its questions carefully discussed by all practitioners whose minds are above mere therapeutics and who have not only the individual but the communal interests at heart. Such clinics would serve also as a source of material for associated research, especially if properly organised research hospitals were instituted, to be directed by the heads of these clinics.

I am, Sir, yours faithfully,

Beeston, Notts, April 22nd, 1917. H. GEORGE P. CASTELLAIN.

THE AGGLUTINATION CURVE AND ITS IMPORTANCE.

To the Editor of THE LANCET.

SIR,—In THE LANCET of March 10th Major G. Dreyer and Captain A. C. Inman make a contribution to this subject, in which they take exception to the "conclusion" arrived at by Lieutenant-Colonel C. J. Martin and Major W. G. D Upjohn, that after triple inoculation (T., A, B) "the interpretation of observations upon the agglutination of enteric organisms will ..... be too difficult to possess any practical value, and the isolation of the infecting organism must be resorted to for diagnosis." Martin and Upjohn's statement can, however, hardly be regarded as a conclusion in the sense that it was their carefully-considered opinion, based on ascertained facts, for at the time they made it no facts relating to the behaviour of agglutinins in enteric fevers occurring in triple-inoculated patients were available. The statement was more in the nature of a prophecy.

Captain E. W. Ainley Walker, in an article in THE LANCET of Nov. 25th, 1916, publishes some cases which, in my opinion, are good illustrations of the difficulty anticipated by Martin and Upjohn. Yet, curiously enough, Captain Walker appears to be entirely unconscious of any difficulty in interpreting his results. On the contrary, he attaches diagnoses which, I venture to suggest, no experienced physician would accept. And, after quoting Martin and Upjohn, he concludes that the difficulty "lies rather in persuading some observers to employ methods which have any practical value in inoculated patients." He refers, of course, to Dreyer's method, in the employment of which, he informs us, no difficulty at all is likely to be met with in the diagnosis and differentiation of the enteric fevers in inoculated patients.

Although Dreyer and Inman's article appears also to be published with the intention of disproving Martin and Upjohn's "conclusion," it does not contain a single relevant fact. Of the 11 cases published, not one had been inoculated with triple vaccine. Nine of the cases were paratyphoid A and B fevers in T.-inoculated patients. It these cases the exact methods referred to by Dreyer and Inman are not strictly necessary in routine work. In a T.-inoculated patient suffering from an illness which presents the clinical features of "enterica" one agglutination test indicating the presence of A or B agglutinins (usually in addition to T.-inoculation agglutinin) is sufficient for a diagnosis of paratyphoid A or B fever respectively. It is true that by using a strictly quantitative technique, and repeating the estimations of agglutinin at intervals of a few days throughout the disease, the diagnosis is rendered more certain, and it is possible in this way to discriminate in many cases, without reference to the clinical facts of the case, between a present and a past infection. But in busy routine work, such refinements are impossible, and, in fact, quite unnecessary. One "positive" result when interpreted by the physician in conjunction with the clinical facts of the case, leads to a correct diagnosis in the great majority of cases.

The exact methods are necessary only in the diagnosis of an infection against which the patient has been inoculated—that is, T. infections in T. inoculated patients (e.g., Cases 10 and 11 of Dreyer and Inman's article), and all "enterica" patients who have had a triple (T., A, B) inoculation (e g., Cases 3, 6, 9, 10, 12, and 13 of Captain Walker's article). In T., A, B inoculated cases the agglutinin response does not confine itself to the homologous agglutinin, but may effect to an equal or even to a more marked extent one or other or both of the heterologous agglutinins. And it is not yet known to what extent other infections having no relation to the enteric group may stimulate T.A.B. inoculation agglutinins. Under these circumstances Martin and Upjohn's prophecy may contain a good deal of truth.

My own experience, up to date, with triple-inoculated patients is that a diagnosis can be made in many cases—but in some cases results are obtained which baffle interpretation. I feel, however, that this difficulty in interpretation of results would disappear if Captain Ainley Walker would kindly explain why Case 10 of his article of Nov. 25th, 1916, is "clearly a case of paratyphoid B infection."

I am, Sir, yours faithfully,

R. P. GARROW,
Captain, R.A.M.C.

Egypt, March 25th, 1917.

THE EXAMINATION OF THE BLOOD OF TYPHUS FEVER CASES BY DARK GROUND ILLUMINATION.

To the Editor of THE LANCET.

SIR,—The description by Dr. W. J. Wilson and Dr. Georgina R. Darling in your issue of April 14th of the spirochæte-like bodies which they have found in the blood of typhus fever cases very strongly resembles that of the bodies with which all dark-ground workers must be familiar in specimens which contain much blood. These show all gradations from a pale, waving thread to one which is broken up by a series of highly refractile dots or minute circles, a common form being a filament with a granule at each end. The threads are apparently motile, with a wriggling motion by which they travel across the field, and they vary in length from 4μ to 20μ, or longer. Sometimes the thread is interrupted in its middle by an oval or circular body, which is about one-third the size of a red blood cell.

I am afraid that I have now damped the hopes of many workers who have adopted the dark-ground method in their search for undiscovered infective agents and have seen in these bodies the possible goal of their researches. For want of a better name I have privately called them "streamers," and they seem to be more abundant in specimens taken from anæmic patients. At one time I thought they were derived from red blood cells, since it is a common event to see in such specimens numbers of red cells with "streamers" attached all round them like fringes, as if the cell membrane had become very ragged. Captain D. Thomson, however, showed me a specimen which he had stained by Leishman's method, and the threads had taken the chromatin stain of nuclei.

I am, Sir, yours faithfully,

L. W. HARRISON,
Lieutenant-Colonel, R.A.M.C.

Military Hospital, Rochester Row, S.W., April 29th, 1917.

MODIFIED TETANUS.

To the Editor of THE LANCET.

SIR,—I read with much interest Captain H. Burrows's article on modified tetanus in THE LANCET of Jan. 27th, as at the time it reached me I had an example of that condition under my care.

The patient, a naval officer on a gunboat, was wounded in the right buttock on Feb. 26th by a machine gun bullet. Hæmorrhage was severe at the time, but was controlled by packing with gauze soaked in Friar's balsam. No antitetanic serum was given. My attention was called to him six days later as twitching had been noticed in the neighbourhood of the wound. He then had clonic contractions of the muscles around the wound, particularly the gluteus maximus; these spasms recurred every few minutes and were very painful and sudden in onset, causing a fleeting contraction of the whole musculature not unlike a tetanic spasm, but unassociated with trismus, dysphagia, or other signs of generalised tetanus. An intramuscular injection of 1500 units of antitetanic serum was immediately given, and shortly afterwards the patient was removed to the theatre, the wound freely opened and counterdrained, and 1500 units injected into the theca. Occasional local spasms occurred throughout the day with lessening frequency, and the patient complained of a feeling of stiffness around the wound. Further intramuscular injections of 1500 units were given the same evening and on the following day. No further spasms occurred, and at the time of writing this, 10 days later, the danger of tetanus is apparently past, but a gas-producing spore-forming organism has been isolated from the wound, which is still septic, while the general condition of the patient is satisfactory.

The chief clinical feature associated with this case was the severe pain elicited by the clonic contractions of the affected muscles; no sensory changes of any sort appear to have been present.—I am, Sir, yours faithfully,

R. J. MCNEILL LOVE,
Captain, R.A.M.C.

At a British General Hospital, Mesopotamia Expeditionary Force, March 14th, 1917.

THE HANBURY MEDAL.—The Hanbury medal, which is awarded biennially for research in the chemistry and natural history of drugs, has been adjudicated to Professor H. G. Greenish, Dean of the School of the Pharmaceutical Society of Great Britain.

The War.

THE CASUALTY LIST.

THE following names of medical officers appear among the casualties announced since our last issue:—

Killed.

Capt. J. E. Black, M.C., R.A.M.C., attached Bedford Regiment, qualified at Glasgow in 1911 and was promoted Captain in October, 1914. The award of the Military Cross was announced in THE LANCET of Nov. 18th, 1916, p. 881.

Lieut.-Col. D. B. Chiles-Evans, D.S.O., R.A.M.C., was educated at University College, Cardiff, and at University College, London, and qualified in 1903. He held the appointment of house surgeon at the Bridgwater Infirmary and joined up at the beginning of the war, at which time he was in practice at Swansea and was assistant medical officer of the Swansea Union and Captain, R.A.M.C., in the 3rd Welsh Field Ambulance, T.F. The award of the D.S.O. was announced in THE LANCET of June 10th, 1916, p. 1195.

Capt. T. Welsh, M.C., South African Medical Corps, was educated at Edinburgh University and qualified in 1910. He held appointments at the Ramsgate General Hospital and at the Royal Infirmary, Edinburgh, and later went to South Africa as medical officer at the Knight Central Mines, Johannesburg. Soon after the outbreak of war he joined the South African Medical Corps, and was awarded the Military Cross in January this year (announced in THE LANCET, Jan. 20, p. 125).

Capt. H. J. Cotter, R.A.M.C., qualified in Ireland at the close of the year 1914, and thereupon joined the R.A.M.C.

Capt. E. J. Blair, R.A M.C., attached Cyclist Battalion, was educated at Edinburgh University, and qualified in 1914. After joining up he was attached for a time to the 5th Battalion Royal Scots.

Capt. L. B. Baird, R.A.M.C., was educated at Manchester University and at the London University, and qualified in 1914. He joined the R.A.M.C. on the outbreak of hostilities and went through the Gallipoli campaign.

Capt. G. D. Ferguson, D.S.O., R.A.M.C., attached Royal Field Artillery, qualified at Edinburgh in 1913. On the outbreak of war he joined the R.A.M.C., and was promoted Captain in August, 1915. He gained the D.S.O. for tending the wounded, of whom he brought in over 50, under very heavy fire (THE LANCET, Nov. 18th, 1916, p. 880).

Capt. R. Home, R.A.M.C., received his medical education at the University of Toronto, and qualified in 1913. He came over with the Canadian Expeditionary Force.

Died.

Col. J. H. E. Austin, A.M.S., was a student at St. George's Hospital, London, and qualified in 1887. He saw service in the Nile Expedition and the South African War, and was the recipient of the Egyptian medal and of the Queen's and King's medal with five clasps. He died at a military hospital in London.

Missing, believed Drowned.

Lieut. I. R. R. Brogden, R.A.M.C., was educated at Ipswich School and at Cambridge, and made his professional studies at Guy's Hospital, London. He qualified in 1916, whereupon he joined the R.A.M.C., and was given six months' leave to act as house surgeon at Guy's Hospital. Later he was posted to Blackpool, and then proceeded to Egypt.

Wounded.

Capt. J. Walker, R.A.M.C., attached Hampshire Regiment.
Major O. L. Appleton, R.A.M.C.
Capt. J. W. Burton, R.A.M.C., attached Royal Scots.
Major A. H. Palmer, R.A.M.C., attached Yeomanry.
Capt. J. P. S. Cathcart, Canadian A.M.C.
Capt. N. Macleod, R.A.M.C., attached H.A.C.
Capt. A. Budd, R.A.M.C., attached Royal Warwickshire Regt.
Capt. A. G. Troup, R.A.M.C., attached London Regiment.
Capt. R. H. Wilson, R.A.M.C., attached R.F.A.
Capt. G. B. Lowe, Australian A.M.C.
Capt. M. Brennan, R.A.M.C., attached Royal West Kent Regt.
Capt. G. H. Kearney, R.A.M.C., attached R.F.A.
Capt. K. P. MacKenzie, R.A.M.C., attached R.E.

Erratum.—By a confusion, which we regret, arising from the identity of initials, the Dr. H. G. Smith who is reported as missing, believed drowned, in the sinking of the hospital ship *Salta*, is Dr. H. G. Smith, of Carnforth, Lancashire, and not Dr. H. G. Smith, lately of Croydon and now in France, as stated in our issue of April 21st, p. 629.

DEATHS AMONG THE SONS OF MEDICAL MEN.

The following sons of medical men must be added to our lists of those who have fallen during the war:—

Major R. N. Macpherson, Indian Infantry, youngest son of the late Brigade Surgeon Lieut.-Col. R. N. Macpherson, A.M.S.

W. R. Erskine, Canadian Contingent, only son of the late Dr. W. Erskine, of Sydenham, Kent.

Second Lieut. H. D. Carless, Gordon Highlanders, younger and only remaining son of Lieut.-Col. A. Carless, R.A.M.C., of Upper Wimpole-street, London.

Capt. B. J. A. Fawcett, East Lancashire Regiment, younger son of Lieut.-Col. E. Fawcett, I.M.S. (retired), of Blackheath, London.

Lieut.-Commander W. W. Hallwright, D.S.O., R.N., youngest son of Mr. M. Hallwright, M.R.C.S., of Edgbaston, Birmingham.

Capt. L. B. Baird, R.A.M.C., elder son of Dr. W. J. Baird, of Bury, Lancs.

Second Lieut. K. I. Mackenzie, Argyll and Sutherland Highlanders, attached Royal Flying Corps, youngest son of Dr. I. Mackenzie, of Ryde, Isle of Wight.

Private M. T. Myles, Canadian Infantry, youngest son of Major E. H. Myles, R.A.M.C., of Nottingham.

Lieut. J. G. Will, Royal Flying Corps, second son of Dr. J. K. Will, of Bethnall House Asylum, London.

Capt. H. G. Smith, R.A.M.C., son of the late Dr. J. Smith, LL.D., a former President of the Royal College of Surgeons of Edinburgh.

Second Lieut. F. C. Coleman, Norfolk Regiment, only child of Dr. P. Coleman, of Clacton-on-Sea, Essex.

THE HONOURS LIST.

The particulars of the gallant deed for which the *Distinguished Service Order* was conferred upon Capt. Allan Watson, R.A.M.C. (announced in our issue of March 24th, p. 468), is now published:—

For conspicuous gallantry and devotion to duty. He went forward under very heavy fire, before his own unit was ordered to advance, and commenced to dress the wounded of another battalion. He worked untiringly under fire both day and night, never resting until all the wounded had been brought in.

The following further awards to medical officers are announced:—

Military Cross.

Capt. John Hardie, Australian Army Medical Corps.

For conspicuous gallantry and devotion to duty. He attended a large number of wounded at the aid post under heavy fire and continued at work after being wounded himself in two places. He set a fine example throughout.

Temp. Lieut. Erach Ruttonji Daboo, I.M.S.

For distinguished service in the field in Mesopotamia.

THE UNITED STATES AND THE WAR.

The American Doctor and the State of War.—Dr. Mahlon Ashford, Captain in the United States Army Medical Corps, discusses in a recent issue of the *New York Medical Journal* the rôle which the American civilian doctor must play "in the great drama of national military preparedness," it being clear that an efficient medical department is a vital military factor for success. The article is of interest to our civil practitioners, so many of whom have undergone, or are about to undergo, similar experiences. The civil practitioner in the vast majority of instances, when he has to leave his present environment for a new one, has to live under conditions totally at variance with former experience, and to treat his sick and wounded under new and difficult conditions of life. Dr. Ashford points out to his American colleagues that if the military doctor fails to respond adequately in the duties imposed upon him, by so much he renders his department inefficient, and if the failure is shared by a very large number of officers the department will break down. "Many an American doctor exclaims," says the author, "'I am ready to serve my country. I am a good surgeon, but I can't bother with red tape.'" To this he replies that the regular Army, and doubtless the Navy, is more than willing to dispense with red tape, but that just as businesses require systematised administration so do Government departments, adding: "If reserve officers suddenly thrown into military life would devote to a study of our business system a moiety of the time they spend cursing our red tape, their service would be happier to themselves and others, and the language would be much poorer in expletive."

Medical Mobilisation: an American View of our Efforts.—The (American) Auxiliary Medical Committee for National Defence has appointed a committee to study the arrangements in England and France under which the practices of doctors entering the services are taken over by those remaining at home to be subsequently returned to their owners. An editorial article in the *New York Medical Journal*, after quoting from THE LANCET of Oct. 28th last an analysis of the causes which prevent the pressure of work of medical men at home being as great as might be expected, adds: "Undoubtedly, if the American practitioner is called upon to face a similar situation, the well-known Yankee ingenuity will come to the fore and suggest many ways of alleviating the pressure. In the meantime, it will be interesting to observe just what will be the ultimate solution which our British cousins will find for their present quandary." We, too, shall watch with interest how America has profited by our example.

Universities and Medical Schools: Organisation of Hospitals.—Nearly 500 Harvard men have so far taken part in the European War: among them being 186 members of the American Ambulance, 95 in the Harvard Surgical Unit, and 15 engaged in other spheres of medical work. The Johns Hopkins Medical School is now organising a base hospital unit to consist of some 300 of its own graduates and students. The Roosevelt Hospital is staffing a Red Cross Base Hospital Unit of 500 beds, under the direction of Dr. Charles H. Peck, who will be assisted by Dr. James I. Russell and Dr. Rolfe Floyd.

Treatment of Tuberculous Soldiers.—The National Association for the Study and Prevention of Tuberculosis has appointed a Commission to consider the existing facilities for the care of soldiers, prisoners, and others, and to take precautionary measures for the prevention of the spread of the disease to the troops. Dr. Herman H. Biggs, the New York State Commissioner of Health, who has been studying the question of tuberculosis and its consequences in the French Army at the request of the French Government, has been appointed chairman of the Commission.

America, it is announced, will send 1000 surgeons to Europe.

Seventy American voluntary Red Cross workers have arrived at Bordeaux from New York.

THE POST OFFICE AND THE WAR.

The Postmaster-General's Report for the year 1915–16 indicates that his gigantic department, in addition to its previously existing functions, has become an immense bureau of the affairs of war. For instance, we find that by Nov. 1st, 1916, 68,000 of the staff had already joined the colours and the military authorities had been informed that 7000 more would be liberated when required. By the same date the additional female staff totalled 35,000. In fact, the number who did not enrol under the Derby scheme was quite microscopic. The 1st Battalion of the Post Office Rifles, whose three battalions are recruited from Post Office servants, has been at the front since the early spring of 1915 and has achieved distinction in many engagements. While the entire personnel of the Army Post Office has been supplied by the Post Office staff in addition large numbers have joined the signal companies (R.E.) and the Naval Signal Units. By the end of the year 1915 over 300 Post Office medical officers had received commissions. A long list of honours, including two V.C.'s, has been won.

In October, 1914, the Post Office undertook the payment of separation allowances, which duty now involves the distribution of approximately £2,200,000 weekly to some 2,700,000 persons, whilst during the year ending March 31st, 1916, upwards of 100 million payments were made, representing a total sum disbursed of about £80,000,000; while the part which it has played in collecting subscriptions to the various forms of War Loan can only be described in figures too big to be realisable. The Post Office collects the correspondence for the troops, which equals approximately 11,000,000 letters and 875,000 parcels weekly, and hands them over to the Home Depôt of the Army Post Office in London for transmission abroad, whilst it also, of course, receives and distributes the whole of the incoming mails from the troops. In March, 1916, parcels to the number of an average of 82,200 per week were dispatched to British prisoners of war abroad, whilst approximately 15,000 per week were received, principally from Germany, for prisoners of war in this country. The telephonic and telegraphic business of the war, proportionately as large as the postal work proper, is also directed by the Post Office.

The last report of the Postmaster-General reveals how potent a force in the life to-day of this country the Post Office is, and its vast activities may be accepted as evidence that the bodily and mental physique of the active personnel must be of a high order, and that the efficiency of the medical officers of the Post Office bears increasingly good fruit.

AUXILIARY R.A.M.C. FUNDS.

Lieutenant-Colonel F. W. H Davie-Harris, secretary of the Auxiliary R.A.M.C. Funds, 124, Victoria-street, S.W., sends us a list of donations, totalling £676 9*s.* 6*d.*, received on account of the Officers' Benevolent Branch for the quarter ending March 31st. The first list appeared in THE LANCET of Feb. 10th, p. 243.

	£	*s.*	*d.*
Alexander, Capt. W. A.	1	1	0
Barclay, Capt. A. E. ...	5	5	0
Balkwell, Capt. F. ...	10	10	0
Ballance, Col. C. A., C.B., M.V.O.	5	0	0
Brownson, Capt. R. O.	1	1	0
Baldwin, Lieut. E. ...	1	1	0
Birr Training Centre, Officers' Mess	50	0	0
Broadbent, Capt. Sir J.	10	0	0
Clark, Col. A. V.	5	5	0
Carter, Capt. B.	1	0	0
Cheyne, Lieut.-Col. Sir W.	21	0	0
Crawford, Lieut. J. P.	1	1	0
Crawford, Capt. J. J....	1	1	0
Cummins, Lieut. M. M.	1	1	0
Douglas, Dr. J., New York (per Sir W. Osler)	100	0	0
Duke, Dr C....	5	0	0
Dowler, Mr. H. M. ...	1	0	0
Ellis Capt. R.	5	5	0
Eadie, Lieut. R. B. ...	1	1	0
Footner, Mr. G. R. ...	25	0	0
Fawcett, Capt. J.... ...	4	4	0
Godlee, Sir R.	6	6	0
Hill, Capt. J....	1	1	0
Hutchinson, Lieut. T. P.	1	1	0
Hendry, Capt. J.... ...	1	1	0
Irving, Capt. C.	1	1	0
Johnson, Rev A. H. (per Lieut.-Col. Collier)	2	12	6
Knaggs, Maj. R. L. ...	10	0	0
Kirton, Capt. J.	1	1	0
Longley, Capt. W. ...	2	2	0
Littlewood, Lieut.-Col. H.	25	0	0
Lewis, Capt. L. A. ...	1	1	0
Lones, Capt. P. E. ...	1	1	0
Lichfield Officers, R.A.M.C.	10	10	0
Leake, Maj. A. M., V.C.	5	5	0
Leachy, Rev. A. E. B...	1	0	0
Mackay, Lieut. A. C. ...	1	0	0
Minch, Capt. J. B. ...	1	1	0
McArthur Capt. G. A. D.	1	1	0
Mullan, Capt. R. F. ...	1	1	0
Moone, Capt. P. W. ...	1	1	0
3rd Northern Gen. Hosp. Officers	48	6	0
Per Sir W. Osler	62	0	0
O'Regan, Lieut. F. W.	1	1	0
Pigot, Capt.	1	0	0
Polter, Capt. J.	1	1	0
Pemberton, Lieut.-Col. R., I.M.S.	5	5	0
Pickering, Maj. H. F.	5	0	0
Ripon Training Centre Officers' Mess	180	0	0
P. D. H. S.	5	5	0
Stewart, Dr. J., Leeds	5	0	0
Telling, Maj. W. S., Leeds	2	2	0
Walker, Capt. J. H. ...	21	0	0
Waddington, Capt., R.A.M.C.	1	0	0
Williams n, Capt. H. ...	2	2	0
Wood, Dr. F. H. (per Lieut.-Col. Collier) ...	5	5	0

ADMINISTRATIVE REFORM IN MESOPOTAMIA.

Mr. Austen Chamberlain has received from Sir Arthur Lawley, the Chief Commissioner of the British Red Cross and Order of St. John in Mesopotamia, a most comforting report of medical and sanitary administration in a zone of the war where our arms previously suffered terrible reverses and our soldiers untold miseries through defects which are now remedied. Nothing, we presume, but the magnitude of our imperial endeavours has allowed the official shortcomings, which marked the first stages of the war in Mesopotamia, to go unaccounted for; it is obvious that the authorities at that time had neither accurate information, reasonable judgment, or any imagination. Sir Arthur Lawley has now gone closely into the general organisation and detailed activities designed to provide adequate welfare for the troops in Mesopotamia, especially for the sick and wounded, and is able to report that we may look forward with perfect confidence to the precautions that have been taken. "The days of muddle," he says, "are ended and order has been evolved out of chaos." Sanitation has been taken in hand, the feeding of the troops from the firing-line to the base is excellent, and rapid evacuation of the wounded from the fighting zone is assured. We have ourselves received, under the same date as that of Sir Arthur Lawley's report, an exact confirmation of his words, though the position of our correspondent prohibits us from publishing his letter. When we remember the difficulties attending a military campaign in such an environment—the heat and the rain, the floods and the flies, the dearth of roads and the abundance of swamps—we have reason to be proud of the determination which has met all these obstacles grimly and has overcome them surely.

A DUBLIN HOSPITAL FOR FRANCE.—A Dublin correspondent writes: Within the past week or two arrangements have been concluded between the War Office and the medical staffs of the Dublin hospitals by which the latter engage to supply the staff of a base hospital in France for at least a year. The selection of the staff has been in the hands of the Presidents of the Royal College of Physicians and of the Royal College of Surgeons, and the services of practically all the hospital physicians and surgeons of Dublin have been at their disposal. Each medical man who is accepted must engage to serve at least three months in France, and he will be given a temporary commission in the Royal Army Medical Corps. The senior surgeon and senior physician will rank as lieutenant-colonels, the other surgeons and physicians as majors, while, doubtless for some good reason for the difference, the specialists—pathologists, ophthalmologists, anæsthetists, and radiographers—will rank as captains. The entire staff will consist at a time of three surgeons, two physicians, and four specialists. The War Office declines to accept any medical man who is under 40 years of age, or, on the other hand, anyone who is "much over 50." The latter exclusion has debarred several active surgeons and physicians, and has evoked some comment in view of the fact that many medical men well past 50 are employed not merely in France but in much more unhealthy climates. If, however, the War Office is in such urgent straits for medical men as its recent actions would imply, it may be ready in a few months to accept competent surgeons who are still physically sound, even if they be past 55. It is worth recalling that a hospital staff such as is now accepted by the War Office was refused on more than one previous occasion when offered by Dublin, and also when offered by Belfast in 1915, and by Cork more recently.

QUININE, PHENACETIN, AND FORMALDEHYDE.—The Army Council are about to take stock of all quinine salts as well as of phenacetin and formaldehyde, with a view of reserving them for army use. All persons holding stocks are to furnish particulars on a form provided by the Director of Army Contracts if the amount exceeds in the case of quinine sulphate 100 oz., of the bi-sulphate 25 oz., of the hydrochloride 25 oz., of the bi-hydrochloride 25 oz., of phenacetin 7 lb., and of formaldehyde (40 per cent.) 10 gallons. In the case of stock exceeding the above quantities a return must be made forthwith, and the excess balance held at the disposal of the War Office.

BRITISH UNIVERSITIES AND THE WAR.—An interesting pamphlet has been issued by the *Field and Queen* (Horace Cox, Limited, Bream's-buildings, E.C.), recording the part played up to date by the Universities of the United Kingdom in the war. The activities of our various Universities are detailed by their respective vice-chancellors, principals, and presidents, or by someone thoroughly representative of the governing body, and in this way an accurate and succinct statement has been secured. The book was compiled at the request of correspondents in the United States, and is prefaced by a brief introduction from the pen of Mr. H. A. L. Fisher, President of the Board of Education, and closed by an essay from Sir Theodore Cook on the Universities of the United States and of Great Britain, dealing largely with athletic exploits.

WINDLESHAM MILITARY HOSPITAL.—The second report of this hospital, No. 16 Surrey V.A.D. British Red Cross Society, states that 739 cases have been admitted and 117 operations performed since its opening in June, 1915. The original arrangement was for 30 beds, but in response to the request of the Aldershot authorities the accommodation has been increased to 50 beds. The hospital is auxiliary to the Cambridge Hospital at Aldershot and to the Connaught. Consequent upon the formation of camps for a portion of the Canadian forces engaged in the neighbourhood as lumbermen in felling and sawing timber, the Canadian medical authorities requested permission to utilise the hospital, and a considerable number of injuries received in this way have been treated

MEDICAL MEN IN IRELAND AND MILITARY SERVICE.—An Irish correspondent writes: At the meeting of the Council of the Irish Medical Association held on April 19th resolutions (see THE LANCET, April 28th, p. 666) were passed calling attention to inconsistency in the attitudes adopted by the Irish Local Government Board and by the War Office in regard to the employment of medical men of military age. The Local Government Board, as is well known, is steadily refusing to sanction the employment, permanent or temporary, in the Poor-law service of any medical man of military age. In some cases, at any rate, this refusal has resulted in dispensary districts being left derelict, owing to the difficulty of obtaining medical men past military age, and the poor have suffered. While the Local Government Board is thus straining its powers to induce medical men to join the Army, the War Office is still employing active young medical men in part-time service in areas where there is no lack of older medical men. Such anomalies are bound to cause comment. It is objected, also, that while the Local Government Board refuses to sanction the employment of young medical men, it has taken no such stand with regard to young men in other walks of life. Boards of guardians are still free to elect young men as clerks and as relieving officers, but not as dispensary doctors.

THE SERVICES.

INDIAN MEDICAL SERVICE.

IT was recently announced in the press that after the open competitive examination held last July for admission to the Indian Medical Service no similar examination would be held during the continuance of the war, but that such appointments as might be required to meet the absolutely indispensable needs of the Service would be made by nomination by the Secretary of State. To assist him in making these appointments which, as already announced, will be limited in number to the absolutely indispensable needs of the Service, Mr. Chamberlain has appointed a Selection Committee who will summon and interview such applicants as may appear to be *primâ facie* suitable, and make recommendations for appointment. Applications for appointment should be addressed to the Secretary of the Military Department, India Office, Whitehall, S.W. 1, and should contain concise particulars of the applicant's medical degrees and career. Applicants must be over 21 and under 32 years of age at the time of application. Particulars regarding pay, promotion, &c., in the Service can be obtained from the Secretary Military Department.

ROYAL NAVAL MEDICAL SERVICE.

The following appointments have been notified:—Staff Surgeon R. R. Fasson to *Inflexible*. Temporary Surgeons: L. H. Woods, C. G. Terrell, W. A. Mein, B. H. Pain, R. Coyte, and J. B. Brash to *Victory*; C. F. Cobb, T. M. Cunnington, H. C. Waldo, and N. Braithwaite to *Pembroke*; A. G. Holman, R. H. Tasker, and J. D. Rutherford to *Vivid*.

To be Temporary Surgeons: E. E. Llewellyn, E. F. S. Gordon, D. W. R. Richardson, F. R. G. Watson, L. L. Fotheringham, A. MacA. Scott, P. G. S. Davis, C. M. Ryley, A. P. Spark, J. T. Wylie, A. D. Marston, R. Wilkins, N. F. Smith, E. D. Scott, J. Fairbrother, R. Coyte, L. H. Woods, J. B. Brash, H. R. Prentice, J. D. Rutherford.

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. F. F. Carroll, D.S.O., from the seconded list, is placed on half pay.

Lieutenant-Colonels to be Acting Colonels whilst employed as Assistant Directors of Medical Services of a Division: G. St. C. Thom, C.M.G., J. W. H. Houghton.

Captains to be Acting Lieutenant-Colonels whilst commanding a Field Ambulance: W. J. Dunn, (Acting Major) W. J. Tobin.

Temp. Col. C. J. Symonds (Major, R.A.M.C., T.F.) reverts to rank of temporary Lieutenant-Colonel on reposting.

To be temporary Lieutenant-Colonels: Lieut.-Col. N. W. Nasmyth, Canadian A.M.C., Major W. Butler, R.A.M.C., T.F. (whilst in charge of the Belmont Hospital).

Majors, Canadian A.M.C., to be temporary Lieutenant-Colonels: E. R. Brown, R. Rankes, H. C. S. Elliott, A. J. MacKenzie, D. A. Clark, C. L. Doherty, R. A. Bowie, F. Guest, E. S. Ryerson, D. P. Kapelle (while O.C. Canadian Cavalry Field Ambulance), J. A. Amyot (while Consultant in Sanitation), T. A. Starkey (while Sanitation Officer), R. Wilson (while Consultant in X Ray and Medical Electricity), L. E. W. Irving, D.S.O. (while O.C. Canadian Convalescent Hospital).

Temporary Majors, Canadian A.M.C., to be acting Lieutenant-Colonels: A. T. Bazin, J. J. Fraser, A. L. C. Gilday, P. G. Bell.

Lieutenant-Colonels, Canadian A.M.C., to be temporary Colonels: K. Cameron, D. W. McPherson, F. G. Finley, W. L. Watt, R. D. Rudolf, C. F. Wylde, R. M. Simpson, F. Etherington (while O.C. Canadian General Hospital, France), J. D. Courtenay (while O.C. Special Eye and Ear Hospital), E. C. Hart (while O.C. Canadian General Hospital).

Lieut.-Col. A. E. Snell, D.S.O., Canadian A.M.C., to be temporary Colonel whilst holding the appointment of Assistant Director of Medical Services.

Temp. Major D. Donald to be temporary Lieutenant-Colonel.

Temp. Capt. G. Gow, Canadian Army Dental Corps, to be temporary Lieutenant-Colonel.

To be temporary Majors: L. Bidwell, A. S. G. Bell, Fleet-Surgeon, R.N. (ret.), A. G. Andrews, Fleet-Surgeon, R.N. (ret.), C. H. Miller, Lieut.-Col. H. H. Balfour, South African M.C. (whilst serving with S. African General Hospital, Richmond).

Temporary Captains to be temporary Majors: J. H. Spencer, N. H. Oliver, J. Bowes.

Temporary Captains, Canadian A.M.C., to be temporary Majors: G. S. Strathey, J. T. Hill, W. H. Tytler, W. Bethune, J. D. Morgan, R. H. Sutherland, G. H. R. Gibson, H. R. MacDermot, S. Ellis, G. W. O. Dowsley, J. C. Calhoun, F. A. C. Scrimger, V.C., R. H.

McGibbon, C. R. Graham, A. K. Haywood, W. A. G. Bauld, J. G. W. Johnson, F. H. Mackay, C. H. Robson, D. E. Robertson, A. W. M. Ellis, E. A. Neff, N. V. Leslie, S. MacV. Fisher, W. M. Hart, W. G. Turner, and the following while doing duty at military hospitals—J. J. Ower, H. E. Paul, A. Croll, R. H. Smith, H. C. Burgess, F. B. Bowman, M. H. Allen, M. M. Crawford, A. MacKay, W. L. Hutton, J. H. Wood, R. H. McDonald, A. H. E. Bennett, O. E. Carr, G. G. Greer. Temp. Capt. H. Buck to be acting Major.

To be temporary Captains: H. L. Tidy, B. M. Collard (late temp. Capt.), J. T. Smeali (late temp. Capt.), R. S. Dobbin, H. H. Prentiss, R. I. Wolfe (Capt. South African M.C., Res. of Off.), R. G. Moffat (Canadian A.M.C.).

Temporary Lieutenants, Canadian Army Dental Corps, to be temporary Captains: J. R. Holmes, G. S. Cameron, O. A. Elliott, C. E. Brown, J. F. Blair, F. W. B. Kelly, E. Kelly, G. V. Morton, C. E. McLaughlan, H. P. Thompson, J. W. Hagey, E. W. Hensinger, H. Ross, H. F. Alford, G. S. Atkinson, H. Clarke, R. Jamieson, A. R. Currie, J. L. Kapelle, O. N. Leslie, W. G. MacNiven, H. P. Travers, D. D. Wilson, E. C. Hutchison, J. F. Morrison, D. P. Stratton, C. H. Moore, J. W. MacDonald, R. H. Atkey, A. G. Lough, E. S. Tait, W. A. Sangster, E. D. Madden, J. F. Shute, G. H. Bray, E. J. Kelly, V. C. W. Marshall, R. C. H. Staples, W. A. Burns, J. F. Morrison, E. McNeill, K. F. Woodbury, R. E. Stone, D. J. Bagshaw, J. T. Adams, C. E. Campbell, A. V. Casiman, E. H. Crawford, J. H. Duff, R. W. Fell, J. S. Girvin, O. Nase, J. W. Reynolds, H. A. Simmons, V. D. Westcott, G. E. H. De Witt, D. H. Hammell, J. G. Roberts, W. F. Baird, E. H. Campbell, H. R. Cleveland, W. P. Desmond, W. R. Fraser, H. G. Goodhand, J. A. Leblanc, R. H. Lipsey, L. D. McLaurin, J. F. O'Brien, B. Rommell, F. E. Smith, J. A. Stewart, F. W. Williamson.

B. H. Alton to be temporary Honorary Captain whilst serving with No. 22 General Hospital.

W. R. Carter to be temporary Honorary Captain whilst employed with the British Red Cross Society in France.

To be temporary Lieutenants: G. Arnott, R. T. Worthington, J. J. Armistead, R. A. MacNelli, R. E. Whitting, E. P. Carmody, T. E. A. Stowell, L. Gray, T. Mohan, C. C. Chance, G. F. Hunter, J. P. Moran, J. W. Fox, W. J. Midelton, H. G. Bywater, H. B. Corry, W. P. S. Johnson, E. McK. Reid, R. Beesley, G. P. Norman, R. H. Adams, G. B. Scott, A. R. Berrie, J. L. Rankine, V. C. H. Dearden, J. E. E. Collins, F. W. Browne, E. W. Sheaf, T. Hamilton, D. Ross, A. G. W. Owen, H. J. Brewer, F. R. Sinton, C. E. Jones-Phillipson, H. V. Deakin, F. J. Thornton, A. G. Dunn, A. G. Gamble, H. W. Jeans, A. P. Morcom, H. G. Sparrow, J. F. MacKay, E. Gardner, E. L. Counceil, R. W. Johnstone, M. L. Farmer, A. MacKintosh, W. H Howat, J. R Stott, G. E. Downs, J. F. Sheppard, R. S. Stevenson, A. H. Sinclair, F. I. Trimmer, V. Colmer, H. S. Johnston, G. L. N. Miles, P. E. H. Patey, H. S. Vivian, G. F. Woodroffe, C. S. Stolterfoth, C. E. Evans, F. W. Stewart, W. M. Brown, M. B. Reichwald, S. J. Kerfoot, M. J. Fogarty, T. J. Killard-Leavey, H. M. MacL. Mackenzie, A. G. Gilchrist, F. Penny, C. F. Beevor, W. N. Eustace, G. H. G. Davie, A. H. Richardson, J. A. Lees, R. H. Crompton, C. H. Haddow, G. N. Montgomery, B. Sakaschansky, E. H. Good, W. B. Douglas-Drummond, P. W. Harrowell, W. H. Newton, J. B. MacKenzie, E. H. Noney, I. J. Roche, F. W. Hayes, G. Barnes, H. E. Barrett, R. H. Dix, H. L. Wilson, J. K. Thompson, R. W. Rix, T. Forde, H. A. Easton, J. B. Jordan, W. O. McKane, S. H. Kingston, G. R. Cox, G. E. Lloyd, W. Robertson, J. N. Payne, J. K. Milligan, J. B. Hughes, A. J. O'Leary, J. J. Reynolds, T. E. Lister, H. L. Pearson, H. S. Mason, R. T. Martin, A. N. E. Rodgers, W. E. Jones, G. Wacher, C. W. Cunnington, F. Baillie, B. K. Nutman, A. A. Bisset, R. Cope. N. B. Walker, C. J. Neilan, G. V. Fiddian, J. McKelvey, L. R. King, D. H. Croom, C. F. Curtis, S. Wigglesworth, C. G. Pugh, M. T. W. Steedman.

Officers relinquishing their commissions: Temp. Maj. S. A. Smith, Canadian A.M.C. (on appointment to R.A.M.C.), Temp. Capt. H. D. Welply (on account of ill-health).

SPECIAL RESERVE OF OFFICERS.

Captains to be acting Lieutenant-Colonels whilst commanding a Field Ambulance: (Acting Major) E. T. Burke, W. Tyrrell.

T. D. Watt, J. S. B. Forbes, G. R. McRobert, from Aberdeen University Contingent, O.T.C., A. Black, J. W. T. Thomas to be Lieutenants.

Officers relinquishing their commissions: Capt. J. H. Bell (on account of ill-health) and Lieuts. (on probation) T. C. Owen and C. D. Crawford.

TERRITORIAL FORCE.

Major E. N. Cunliffe to be acting Lieutenant-Colonel whilst acting as Administrator.

Capt. W. P. Ferguson to be acting Lieutenant Colonel whilst commanding a Field Ambulance.

Capt. (temp. Lieut.-Col.) H. K. Dawson reverts to the temporary rank of Major on ceasing to command a Field Ambulance.

Capt. (temp. Major) J. W. Leitch to be acting Lieutenant Colonel whilst commanding a Field Ambulance.

A. R. Muirhead and A. G. Yates to be Lieutenants.

Capt. T. J. Murray is restored to the establishment.

Lieut. S. Henry resigns his commission.

VOLUNTEER FORCE.

R. R. Jones to be temporary Lieutenant and Medical Officer, 1st Battalion, Carnarvonshire Volunteer Regiment.

NORFOLK AND NORWICH HOSPITAL.—The 145th annual report of this institution dealing with the year 1916 states that the total income, exclusive of legacies and special donations for investment, was £30,766, and the total expenditure £31,898, the deficit being largely due to the enhanced cost of supplies. An analysis of the patients treated during the year shows that (on the civilian side) 1162 were "cured," 481 "relieved," 185 "not likely to receive further benefit," while 136 died and 125 were still in hospital on the last day of the year. On the military side, 1710 were discharged to sick furlough or convalescent homes, 18 died, and 97 remained in hospital at the end of 1916.

Medical News.

ROYAL COLLEGES OF PHYSICIANS AND SURGEONS OF EDINBURGH AND ROYAL FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW.—At examinations held recently the following candidates were successful:—

Third Examination.—Richard Arthur Cooper, Apcar Galustian, William Francis Gawne, John Vaughan Griffith, George Henry Charlesworth Harding, Henry Jennings, Agnes Emilie Keen, Clifford Pullan, Len. Philip Samarasinha, and Maurice Julius Woodberg.

Final Examination.—Mary Gray Jones, Robert Austin, Samuel Saxon Barton, Rayner Laming Bellamy, Archibald Buchanan MacDougall, Alexander Balfour Black, William Brown, Norman Stewart Bruce, Lloyd William Hughes, Edward Glyn Jones, Robert Gloag Battersby, John Joseph Mulvey, Don Adrian Jayasinghe, and Russell Nelham Burton.

ROYAL MEDICAL BENEVOLENT FUND.—At the last meeting of the committee, held on April 17th, 20 cases were considered, and £163 granted to 16 of the applicants. The following is a summary of some of the cases relieved:—

L.R.C.P. & S. Edin., aged 81, married, who practised in Cheshire and Yorkshire. Applicant became totally deaf a few years ago and consequently lost his practice. His wife is an invalid aged 80 years. Has three daughters, two married, and the youngest, aged 46, looks after her parents. Total income from all sources £89, and pays £28 in rent. High cost of living and illness have made it necessary to apply for help. Voted £26 in 12 instalments.—Daughter, aged 79, of M.D. Glasg. who practised at Reading and Derby and died in 1867. For many years, and until recently, lived with an old friend, a dressmaker, and they shared their slender resources. The friend now dead. Only income 7s. 6d. per week from a distant relative but this may cease any time. She has applied for the Old Age Pension. Health very bad. Voted £5 and the case to be reconsidered shortly.—Widow, aged 48, of M.B. Aberd. who practised at Ahwaz, Persia, and died there in July, 1916. Applicant left without means, with three children, ages 10 to 13. Friends have helped to furnish a house so that she may take in lodgers, but so far has not been very successful. Her husband left Persian carpets and curios in Persia valued at £380, but these cannot be moved at present. There are, however, debts to the extent of £260. Voted £10.—Widow, aged 65, of M.R.C.S. Eng. who practised at Streatham and died in 1914. Applicant was left with slender means and has a delicate daughter. Has £30 from another charity and about £20 from investments. She has recently had a stroke. Relieved three times, £36. Voted £15 in 12 instalments.—Daughter, aged 55, of M.R.C.S. Eng. who practised at Newport, Mon., and died in 1892. Applicant left unprovided for, and is very delicate. She is blind in the left eye and the other is very weak. Has recently had an internal operation. Only income a pension of £21 from another charity and help from the Guild. Relieved six times, £72. Voted £15 in 12 instalments.—Daughter, aged 69, of M.D. Edin. who practised at Hornsey and died in 1888. Applicant is the matron of an orphanage, but owing to the decrease in the subscriptions receives no salary, only home and food. Relieved three times, £17. Voted £12 in 12 instalments.—Daughter, aged 64, of M.R.C.S. Eng. who practised at Regent's Park, N.W., and died in 1853. Owing to ill-health was obliged to live on her capital, now exhausted. Has an annuity of £25 from another charity and endeavours to make a little by keeping poultry, and a friend lends her a small house. Relieved four times, £36. Voted £6 in 12 instalments.—Widow, aged 47 of M.B. Edin. who practised at Ballindalloch and died in 1910. Applicant was left unprovided for with four young children. The eldest, aged 18, has now joined the Army, and the others are still at school. Tries to make a living by taking lodgers, but cannot make enough to live on. Relieved five times, £50. Voted £10 in two instalments.—Widow, aged 61, of M.R.C.S. Eng. who practised at Maida Vale and died in 1904. Left totally unprovided for, and only able to earn a few shillings a week as a cook when her health will permit. Suffers from rheumatism. Relieved 13 times, £124. Voted £15 in 12 instalments.—Widow, aged 53, of M.B. Aberd. who practised in Warwickshire and Australia and died in 1907. Left entirely without means with three children. Son now in the Army and unable to help her, and two daughters earning their own livings and away from home. Only income about £60 a year from a relative, but this is required to pay for board and lodging. Relieved nine times, £97. Voted £12 in 12 instalments.—Widow, aged 47, of M.D. Aberd. who practised at Sheffield and died in 1906. Left without means with a young son, who is now living with a relative. Applicant's health for some time has been very indifferent, but has improved recently, and she has obtained employment at a munition works. Relieved three times, £30. Voted £10 in two instalments.

Subscriptions may be sent to the acting honorary treasurer, Dr. Samuel West, at 11, Chandos-street, Cavendish-square, W. 1.

WEST LONDON MEDICO-CHIRURGICAL SOCIETY.—A reception by the President and Council of the Society will be held at the West London Hospital on Wednesday, May 23rd, at 8.30 P.M., when the West London Medal will be presented to Fleet-Surgeon Francis Bolster, B.A., M.D., and Major H. E. Priestly, R.A.M.C., for exceptional heroism in the discharge of medical duties.

LONDON MISSION HOSPITAL, SIAOCHANG, CHINA.—The report of this hospital for the year 1916 shows that in spite of difficulties created by the high price of food and drugs and the inconveniences caused by the repair and improvement of old buildings, much good work has been accomplished. Under the supervision of Dr. Ernest J. Peill and the house surgeon, Dr. Wu San Yuan, indoor treatment was given to 287 male patients and 94 female patients. The new out-patients numbered 4203 and the old patients 1599. 534 operations had been performed.

EDINBURGH UNIVERSITY.—The General Council of the University approved on May 2nd a draft ordinance for the foundation of a chair of Medical Chemistry.

WINSLEY SANATORIUM, NEAR BATH.—At the recent annual meeting of the friends of this institution the medical report stated that during 1916 the patients numbered 455, compared with 392 in 1915. The average stay of each was 80 days. The facilities offered at the sanatorium had been largely utilised for the treatment of tuberculous patients discharged from naval and military hospitals.

THE LATE MR. WALTER GIBSON.—Walter Gibson, M.R.C.S., L.R.C.P., who died on March 14th after an operation at the Lady Dudley Nursing Home in Johannesburg, was 50 years of age and had latterly been a gold-mining medical officer at Pilgrim's Rest, Transvaal. Son of the late John Gibson, of Basinthorpe, Lincolnshire, on leaving Guy's Hospital he went to Australia, settling in practice at Coolgardie. During the South African war he joined a West Australian contingent, remaining subsequently at Johannesburg, where he became well known.

Professor Arthur R. Cushny will deliver the second Sydney Ringer Memorial Lecture on Friday, May 25th, at University College Hospital Medical School, at 4 P.M., the subject being "Digitalis and Auricular Fibrillation."

Parliamentary Intelligence.

NOTES ON CURRENT TOPICS.

The Budget.

Mr. Bonar Law's proposals in his Budget statement of Wednesday, May 2nd, do not include any new taxation; increased taxes on excess profits, tobacco, and entertainments are expected to provide sufficient new revenue for the current year.

Criminal Law Amendment Bill.

In the discussion on report of the Criminal Law Amendment Bill in the House of Commons on Monday, April 30th, proposals were brought forward to enable more stringent action in respect of prisoners infected with venereal disease and of the wilful transmission of disease.

Mr. HAYES FISHER remarked that the debate had shown that on the whole the House was more in favour of a policy of persuasion than a policy of penalty. He thought that Clause 5 in the Bill would cover a case where a man who knew that he was infected with syphilis, being a milkman went on milking cows, so that an innocent person got the disease. He was satisfied that the Local Government Board had power to make regulations under the Public Health Act, 1875, relating to venereal disease, and if they had that power they were able to go a long way to meet the case where men and women disregarded information and proceeded to infect innocent people.

Venereal Disease Bill.

The Venereal Disease Bill came before a Standing Committee of the House of Commons on Tuesday, May 1st, but slow progress was made with its consideration.

Clause 1 provided that in any area in which the Act was in operation there should be prevention of the treatment of venereal disease or the supply of remedies therefor otherwise than by duly qualified persons.

Mr. KING moved an amendment to take out the qualification implied in the phrase "in any area in which this Act is in operation." That would, he said, make the application of the Bill general.

Mr. GLYN-JONES supported the idea that the Bill should be of general application. If this were not so, pharmacists in one town would be under a disability which might not apply to those in a neighbouring town.

Mr. H. SAMUEL observed that the Government would be well advised not to suppress any means of treatment until alternatives were provided. It should be made clear that the Local Government Board would not apply the Bill to any area until the provisions for treatment were adequate.

Mr. HAYES FISHER intimated that the areas of application would be few and large, counties even being joined. The Local Government Board was arranging for covering the country with clinics.

The amendment was rejected by 21 votes to 8.

Mr. HAYES FISHER stated that he would propose an amendment to Clause 2 (Operation of the Act) that it would only be brought into operation "in any area in respect to which a scheme for the treatment of venereal disease had been approved by the Local Government Board."

Mr. DILLON moved an amendment to the effect that the medical man treating the disease should be one holding a certificate of competency to treat venereal disease.

Mr. HAYES FISHER declined to accept the amendment. A medical man might have been treating the disease for years and not possess such a certificate. Where was a medical man to obtain such a certificate? This was an impossible proposal.

The amendment was negatived without a division.

The committee adjourned.

HOUSE OF COMMONS.

WEDNESDAY, APRIL 25TH.

Medical Reclassification in the Army.

Answering Mr. HOGGE, Mr. MACPHERSON (Under Secretary for War) stated that B 3 and C 3 men would not be passed as fit for general or other category of service unless their health improved sufficiently to warrant reclassification.

Mr. PRINGLE: Is there any security that an adequate and sufficient examination will be given before these men are passed for general service?—Mr. MACPHERSON: I have stated over and over again in this House that we were proposing to have the most competent medical boards available.

Men Discharged for Tuberculosis.

In reply to Mr. BILLING, Mr. MACPHERSON said: Officers who have ceased to hold commissions and men who have been discharged from the Army suffering from tuberculosis are not expressly excepted from the provisions of the Military Service (Review of Exceptions) Act, 1917. But my honourable friend will realise that the Army does not wish to introduce to its ranks persons suffering from tuberculosis.

Mr. HOGGE: Can my honourable friend give the House an assurance that before a man suffering from tuberculosis is taken the usual application shall be made to the Local Government Board for his medical record as a tuberculosis patient?—Mr. MACPHERSON: I shall see what can be done.

Medical Examinations in Prisons.

Commander WEDGWOOD asked the Under Secretary for the Home Department (1) whether women convicted of soliciting could now be medically examined for venereal disease if sent to prison, and, if so, under what Act of Parliament; and (2) whether his attention had been called to the arrest of two women who were sent to Holloway, medically examined for syphilis, and then acquitted; whether the prison authorities had power to have women committed or remanded medically examined without a magistrate's order; and, if not, under what power the police, magistrates, or prison officials acted.—Mr. BRACE replied: All prisoners are medically examined on reception under the Statutory Prison Rules. No prisoner is locally examined for venereal disease without his or her consent, and a magistrate has no power to order such an examination. In the case referred to, the magistrates requested the medical officer to report whether the prisoners were suffering from venereal disease, and the medical officer was able to report that in neither case was there any indication of such disease. Neither of the prisoners raised any objection to being examined. I propose to ask the Brentford magistrates what justification they had for asking for an examination in this case. There has been no time to communicate with them since the question appeared on the paper.

Ministry of Health.

Mr. GOLDSTONE asked the Parliamentary Secretary to the Local Government Board whether it was proposed to establish a Ministry of Health, and, if so, whether he would be in a position to make a full statement at an early date as to the character and extent of the work which would be undertaken by the Ministry.—Mr. HAYES FISHER replied: Proposals of this character are under consideration. I cannot, however, promise any definite date for a statement on the subject.

Training Disabled Soldiers.

Mr. G. TERRELL asked the Pensions Minister what steps, if any, had been taken to stimulate action between local war pensions committees for the purpose of training disabled soldiers and sailors.—Mr. BARNES wrote in reply: The Parliamentary Secretary and I have held meetings of representatives of local war pensions committees and heads of training institutions in various parts of the United Kingdom, and have received most satisfactory promises of coöperation in schemes for making available the best training facilities in large areas to all the local committees working in those areas. We are now in consultation with the Statutory Committee, adopting their inspection organisation to ensure early practical effect being given to those schemes.

THURSDAY, APRIL 26TH.

Payments to Panel Practitioners.

Sir P. MAGNUS asked the representative of the National Insurance Commissioners whether the amounts due to doctors for the year 1916 had been computed; when the balance outstanding would be paid; and whether, in view of the increase in the cost of living, a small sum could be released forthwith.—Sir E. CORNWALL replied: The accounting operations are being expedited as much as possible with a view to enabling Insurance Committees to effect

an emergency settlement with doctors for 1916, and it is hoped that the necessary information will be in the hands of the committees within a few weeks. I understand that Insurance Committees have already advanced to the doctors as large a sum as can safely be paid in anticipation of the settlement, and I doubt whether any additional advances, entailing, as they would, a serious risk of overpayment and subsequent recovery from the doctor, would in these circumstances be welcomed by the profession.

FRIDAY, APRIL 27TH.

Inoculation Department of St. Mary's Hospital.

Mr. WING asked the Financial Secretary to the War Office what amount of public money had been expended by his department upon the supply of vaccines from the inoculation department at St. Mary's Hospital.—Mr. FORSTER replied: Grants-in-aid to cover the cost of materials used and the extra laboratory expenses involved in the preparation of vaccines for use in military hospitals amounting to £4465 have been made to the inoculation department of St. Mary's Hospital.

MONDAY, APRIL 30TH.

Treatment of Blinded Soldiers in Scotland.

Answering Mr. DUNCAN MILLAR, Mr. BARNES (Pensions Minister) said: Arrangements have been completed by which the facilities afforded at Newington House, Edinburgh, are to be utilised to the full extent necessary for the treatment of blinded sailors and soldiers domiciled in Scotland. The committee of Newington House have also made themselves responsible for the settlement of men trained there and have charged themselves with the after-care of these men. I would add with reference to an answer which I gave to a question in the House on March 8th last that a conference between the authorities of Newington House in Edinburgh and St. Dunstan's in London, held at my suggestion, has resulted in the complete and cordial agreement for coördinating the work of these two establishments.

TUESDAY, MAY 1ST.

Calling up the Medical Profession.

Mr. MACVEAGH asked the Under Secretary for War, with reference to the conscription of doctors, whether he could state on what date the War Office discovered that they stood in need of further medical assistance.—Mr. MACPHERSON answered: The need of assistance from the medical profession has, of course, been continuous. If my honourable friend refers to the recent call, I think he is aware that it is consequent on the decision to establish more hospitals overseas.

Appointments.

Successful applicants for vacancies, Secretaries of Public Institutions, and others possessing information suitable for this column, are invited to forward to THE LANCET *Office, directed to the Sub-Editor, not later than 9 o'clock on the Thursday morning of each week, such information for gratuitous publication.*

SHEARER, A., M.B., Ch.B. Edin., has been appointed Medical Officer to the Newtown Urban District Council for the period of the war.

ST. THOMAS'S HOSPITAL.—Casualty Officers and Resident Anæsthetists: WOOLRICH, W. G., PEARCE, A. H., HARTLEY, L. B., and DAVIES, P. G. S. Resident House Physicians: BESWICK, W. T., MAVROGARDATO, A., ANWYL-DAVIES, T., and HIGGINS, L. G. Resident House Surgeons: GILKS, J. L., JENNINGS, H. C., LEATHAM, H. W., and ROWLAND, J. House Surgeon to Block 8: MARRIOTT, W. Obstetric House Physician: PINK, C. V.

Certifying Surgeons under the Factory and Workshop Acts: BALL, E. J., Paignton, Devon; MCCLURE, T., L.R.C.P. & S. Edin., L.F.P.S. Glasg., Glyn-neath, Glamorgan; and OLLERHEAD, T. H., L.R.C.P. Lond., M.R.C.S., Minehead, Somerset.

Vacancies.

For further information regarding each vacancy reference should be made to the advertisement (see Index).
When the application of a Belgian medical man would be considered the advertisers are requested to communicate with the Editor.

APPLECROSS, ROSS-SHIRE.—Medical Officer and Public Vaccinator. Salary £320 per annum.

BERMONDSEY MEDICAL MISSION FOR WOMEN AND CHILDREN.—Qualified Medical Woman as Locum. Salary £150, with board and residence.

BODMIN, CORNWALL COUNTY ASYLUM.—Female Junior Assistant Medical Officer. Salary £200 per annum, with board, &c.

BOLINGBROKE HOSPITAL, Wandsworth Common, S.W.—House Surgeon. Salary £150 per annum, with board, &c.

BOLTON INFIRMARY AND DISPENSARY.—Second House Surgeon. Salary £200 per annum, with board, &c.

BRIGHTON, ROYAL SUSSEX COUNTY HOSPITAL.—Senior House Surgeon. Salary £140 per annum, with war bonus.

BRISTOL ROYAL INFIRMARY.—House Physician and House Surgeon. Salary at rate of £120 per annum, with board, &c.

BURSLEM, HAYWOOD HOSPITAL.—Female Resident Medical Officer. Salary £200 per annum, with board, &c.

BURY INFIRMARY.—Junior House Surgeon. Salary £150 per annum, with board, &c.

CUMBERLAND, COUNTY OF.—Female Assistant Medical Officer. Salary £350 per annum.

DERBY, DERBYSHIRE ROYAL INFIRMARY.—Two House Surgeons. Salary £200 per annum, with board, &c.

EVELINA HOSPITAL FOR CHILDREN, Southwark, S.E.—House Physician. Salary at rate of £160 per annum, with board, &c.

HOSPITAL FOR CONSUMPTION AND DISEASES OF THE CHEST, Brompton.—House Physician for six months. Salary 30 guineas.

HULL, VICTORIA HOSPITAL FOR SICK CHILDREN.—House Surgeon.

IPSWICH, AUXILIARY HOSPITAL FOR WOUNDED, Lattice Barn.—House Physician. Salary as arranged, with board, &c.

IPSWICH, EAST SUFFOLK AND IPSWICH HOSPITAL.—Two Female Resident Officers.

JOHANNESBURG, SOUTH AFRICAN SCHOOL OF MINES AND TECHNOLOGY.—Professor of Anatomy and Professor of Physiology. Salary £1000 per annum each.

LEICESTER ROYAL INFIRMARY.—Two Resident Surgical Officers. Salary £250 per annum, with apartments, &c.

LIVERPOOL COUNTY ASYLUM, Rainhill.—Temporary Assistant Medical Officer. Salary 7 guineas a week, with board, &c.

MANCHESTER, CITY OF.—Temporary Assistant Tuberculosis Officer. Salary £400 per annum.

NEWCASTLE-UPON-TYNE, ROYAL VICTORIA INFIRMARY.—Resident Medical Officer. Salary at rate of £300 per annum, with board, &c.

NOTTINGHAM CHILDREN'S HOSPITAL.—Female House Surgeon. Salary at rate of £200 per annum, with board, &c.

NOTTINGHAM CITY ASYLUM.—Locum Tenens. Salary £7 7s. per week, with board, &c.

NOTTINGHAM GENERAL HOSPITAL.—Two Assistant House Surgeons for six months. Salary at rate of £250 per annum each, board, &c.

NOTTS COUNTY COUNCIL.—Second Assistant Tuberculosis Officer. Salary £400 per annum.

QUEEN MARY'S HOSPITAL FOR THE EAST END, Stratford.—Casualty Officer.

RHONDDA URBAN DISTRICT COUNCIL.—Temporary Assistant Medical Officer of Health and School Medical Officer. Salary £350 per annum.

ROYAL FREE HOSPITAL, Gray's Inn-road, W.C.—Senior Resident Medical Officer. Salary £200 per annum. Also House Physician (salary £50 per annum, with board, &c.), to include duties at Endsleigh Maternity Hospital. Salary given.

SHEFFIELD ROYAL INFIRMARY.—House Physician. Salary £120 per annum, with board, &c.

VICTORIA HOSPITAL FOR CHILDREN, Tite-street, Chelsea, S.W.—Temporary House Physician. Salary at rate of £200 per annum, with board, &c.

WARWICKSHIRE AND COVENTRY JOINT COMMITTEE FOR TUBERCULOSIS.—Temporary Tuberculosis Officer. Salary £500 per annum.

WELLS ASYLUM, SOMERSET.—Temporary Assistant Medical Officer. Salary £300 per annum, with board, &c.

WESTERN GENERAL DISPENSARY, Marylebone-road, N.W.—Honorary Ophthalmic Surgeon.

WORCESTERSHIRE, KING EDWARD VII. MEMORIAL SANATORIUM, Knightwick.—Medical Superintendent. Salary £450 per annum, with board, &c.

THE Chief Inspector of Factories, Home Office, London, S.W., gives notice of a vacancy for a Certifying Surgeon under the Factory and Workshop Acts at Grosmont, Yorks.

Births, Marriages, and Deaths.

BIRTHS.

BARNETT.—On April 25th, at Gernrode, Berkhamsted, Herts, the wife of Dr. Burgess Barnett, of a daughter.

HEDLEY.—On April 30th, 1917, at 65, Harley-street, W., the wife of John Prescott Hedley, F.R.C.S., Captain, R.A.M.C. (T.), of a son.

RYLAND.—On April 28th, at West Cottage, Wrecclesham, Farnham, the wife of Captain Ryland, R.A.M.C., of a son.

MARRIAGES.

DORE—GREATWICH.—On April 26th, at Holy Trinity Church, Sloane-street, Captain N. A. Dore, R.A.M.C., to Dulcie, eldest daughter of Mr. and Mrs. Greatwich, Lickhill Manor, Stourport.

GRAY—COOPER.—On April 26th, at St. John's, Red Lion-square, Archibald Montague Henry Gray, M.D., Major, R.A.M.C., T.F., to Elsie, youngest daughter of the late F. B. Cooper, of Newcastle, Staffs.

READE—NEWMARCH.—On April 28th, at Christ Church, Streatham-hill, by the Rev. H. D. L. Viener, M.A., R.N., Senior Chaplain, Royal Naval Barracks, Chatham, Surgeon Arthur G. L. Reade, R.N.V.R., younger son of the late Arthur Edward Reade, Esq., and Mrs. Reade, of Streatham, to Violet Newmarch, M.R.C.S., L.R.C.P., only daughter of Henry Newmarch, Esq., and Mrs. Newmarch, of Vancouver, B.C.

REES—MACLEOD.—On April 28th, at St. Columba's, Pont-street, London, Captain W. A. Rees, R.A.M.C., to Christine, daughter of Mr. and Mrs. Macleod, Portvoller, Stornoway.

WALL—TRIPP.—On April 28th, at St. Luke's, Chelsea, Reginald Cecil Bligh Wall, M.A., D.M., F.R.C.P., to Dorothy, younger daughter of Mr. and Mrs. Herbert Innes Tripp.

WALLACE—NORRINGTON.—On April 28th, at Plymouth, Captain Quentin Vaughan Brooke Wallace, M.C., R.A.M.C., to Freda, youngest daughter of Mr. and Mrs. A. R. Norrington, of Plymouth.

DEATHS.

BROGDEN.—On April 15th, missing, believed drowned, Lieutenant Ingram R.R., R.A.M.C.

STEAR.—On April 25th, at Saffron Walden, Henry Stear, M.R.C.S., aged 87.

WOOD.—On April 23rd, killed in action, Lieutenant Paul Bernard Wood, M.A., LL.B., L.D.S., Royal Fusiliers, aged 31.

N.B.—A fee of 5s. is charged for the insertion of Notices of Births, Marriages, and Deaths.

Notes, Short Comments, and Answers to Correspondents.

RHUBARB.

RHUBARB is now becoming plentiful and is very largely used as an addition to the diet. The root also is greatly in demand for medicinal purposes, the best varieties being collected in China and Thibet. The following account of the history of rhubarb in this country is of some interest.

The edible rhubarb was introduced into England in 1573, but only the leaves apparently were eaten. Mr. William Hayward, apothecary, of Banbury, seems to have been the original cultivator of rhubarb in that locality. In a letter, dated Oct. 29th, 1789, addressed to Mr. More, secretary to the Society of Arts, Mr. Hayward states that he had been a cultivator of "the true Turkey rhubarb" for about 12 years; and "had so far succeeded, as to have disposed of and used, within the last three years, more than two hundredweight of that article"; and he therefore offered himself as a candidate for the Society's premium for promoting the culture of this useful drug. The Society, however, only "voted their silver medal to him as a bounty." In 1791 he claimed the Society's gold medal for raising the greatest number of rhubarb plants, and this was adjudged to him by the Society. The seed came from Russia. Overall, the chronologer, said that "the Society of Arts gave a gold medal to Mr. Ball for the cultivation of this esculent in 1790, and to Mr. Thomas Jones, of Enfield, in 1793, and again in 1797.

Lindley in his "Flora Medica" (1838) says: "It is stated by Stevenson and Churchill that *Rheum palmatum* is extensively cultivated near Banbury for the supply of the London market," but Mr. William Bigg made the statement in 1846 that in the neighbourhood of Banbury "only one species is in cultivation for medicinal sale: the *Rheum rhaponticum*. It has no distinctive popular name." He added:

> The principal, and with a small exception, the only mart for English rhubarb root is London. It is there purchased by the wholesale druggists, who would probably state that a great part of it is subsequently exported. Some of it is sold no doubt to the Jews and Turks *as English*, but I strongly suspect that a much larger portion is sold to the Christians as *foreign*. The "cuttings" make I dare say a very decent powder, mixed according to conscience with East India rhubarb.

Lindley said the English sort was sold by itinerant vendors who carried the delusion further by arraying themselves in Oriental costume. Mr. Bigg continued:—

> I have heard it stated on computation that not less than about twenty tons are, in the various forms described, annually sent into the market. I know of no other place in which rhubarb is grown for medicinal purposes in a wholesale way. A field of rhubarb when in flower—the stalks from six to ten feet in height—has a very striking appearance, and cannot be passed without observation. The leaf-stalk grown in private gardens is not unfrequently preserved with sugar, and is recommended in that form by Dr. Kerr, of Northampton, as a laxative.

A part of Mr. Bigg's statement which has particular interest at the present time is as follows:—

> Of the leaves, I believe no use is now made, except the use common to all vegetable offal—manuring. The leaf stalks are now very partially sold for the table. In former years, the sale of the leaf stalks formed a part of the trade, but it can scarcely be said to do so now. Wine has been occasionally made of them, but not to any important extent. Curious housekeepers here and there make a little to increase the variety of the table at the village "wake."

Lindley relates that "in Queen Elizabeth's time rhubarb leaves were used as a potherb and considered superior to spinach or beet. The use of the tender leafstalks is comparatively of modern date for tarts, &c." A French chronicler years ago stated, apparently surprised, that "in England, Sweden, and Siberia they eat the leaves and young shoots." One well-known English writer on food says: "The leaves were formerly boiled and made into a sauce for meat." If the leaves are indeed "superior to spinach," they could now be boiled and eaten as greens instead of being thrown away, and we could thus form a link with the Elizabethans. No doubt a good deal depends on the species of rhubarb whether its leaves are tasty. They certainly can be eaten either plain or mixed with other greens.

In the *Gardeners' Chronicle* for 1846 Mr. A. Forsyth first directed attention to another part of rhubarb as being suited for culinary purposes and to which he gave the name of rhaflower—this is the large globular pouch of unopened flowers. It was perhaps in 1820 that the stalks were first used for tarts and jam, but Dr. John Fothergill perhaps used in that way some of the gigantic rhubarb he raised in 1778. He had a botanical garden at Upton, near Stratford, Essex.

THE COOLIDGE X RAY TUBE.

IN a catalogue which we have received from the British Thomson-Houston Company, Limited, Mazda House, Upper Thames-street, E.C., is an interesting and illustrated account of the Coolidge focus tube in its latest form. In all focus tubes that preceded the new design, the discharge between the cathode and anti-cathode, and therefore the production of X rays, was dependent upon the presence of residual gas in the tube. During use the gas is driven to the walls of the tube and the discharge stops, the operation of the tube on this account being uncertain and variable. In the Coolidge tube, however, exhaustion is carried to a much higher point, the pressure of the remaining gases not being greater than a few hundredths of a micron (0·001 mm.). Through this attenuated atmosphere no discharge will pass even when a current at 100,000 volts is applied to the terminals. In order to create a conducting path between the electrodes, the cathode is furnished with a small flat and closely-coiled spiral filament of tungsten wire placed within a conducting cylinder or ring connected to it, and so placed that the cathode rays are focussed upon the target or anti-cathode. This filament is heated continuously, while the tube is in operation, by current from a portable accumulator or from some other source of supply at a suitable voltage. In its completed form the length overall of the Coolidge tube is 20 inches and its greatest diameter 8 inches. The extremely high penetration secured is much greater than was possible with any earlier design. It can readily be adjusted to give any required penetration, this being determined by the voltage across the terminals, the volume of discharge between the electrodes being dependent upon the value of the current passed through the heated filament. In a few seconds the tube can be altered to give a hard or soft effect, and it will maintain any required degree of hardness for an indefinite period. Stability is shown by the fact that it may be used by many operators for several hours daily without any adjustment and with no perceptible variation in results, its life averaging upwards of 1000 running hours. For therapeutic, fluoroscopic, and most radiographic work a tube with medium focus is suitable, but fine or broad focus spots can be furnished, the former being suitable for the most rapid radiographic purposes.

THE SWARREN CRUTCH-SEAT.

Messrs. Graham and Latham, Limited, military engineers, of 104, Victoria-street, S.W., have sent us a simple but ingenious device for providing a ready means of rest for those who are under the necessity of using crutches. It consists of a stout canvas webbing, 3 inches wide, with steel attachments at each end for affixing to crutches with cross-bar hand-pieces. When fixed the band and the crutches together take the form of a large capital H with the cross-piece in concave shape to form the seat. The band can be carried in the pocket, it is made to fit any standard crutch, and the steel attachments firmly and automatically lock themselves to the crutches. The price, carriage paid, is 7*s.* 6*d.*, but a substantial discount is, we understand, given to Red Cross and allied societies.

OPTICAL AIDS.

To the Editor of THE LANCET.

SIR,—In the "Personal" column of the *Times* a few days ago there appeared a notice reminding officers and others invalided home who have no further use for glasses issued to them by Lady Roberts's Field Glass Fund that they should return them for re-issue to Lady Roberts, 64, Victoria-street, London, S.W.1. It was stated that "the need now for glasses is more urgent than ever." The following hints may be useful in emergencies, failing the supply of proper glasses. I have found that two ordinary eyeglasses (monocles) make, in a suitable leather pocket-case, probably the most compact small-range telescope obtainable. A moderately strong concave eye-glass placed by one hand quite close to the eye, and a quite weak convex eye-glass held by the other hand more or less at arm's length, according to focus, will give good results if the eye-glasses are suitably chosen; and a curious telescope may be made by looking through the clear solid bottom of a drinking-glass (tumbler), which generally acts as a diminishing lens, in conjunction with a slightly magnifying lens held in the other hand. A short-sighted man who has lost his spectacles has been provided by Nature with a temporary emergency aid by making the letter q with his fingers—that is, the index-finger and thumb of the left hand are pressed together like the loop of the q, and the right hand index-finger touches the two tips like the stroke of the q. By pressing the straight finger more or less on the "looped" fingers and looking through the tiny triangular aperture or space between the finger-tips, the myopic man can see the distant scene distinctly. A short-sighted man can use a single convex lens held more or less at

arm's length, as a telescope (although the image is inverted). Again, the combination of lenses forming the top "draw" of a terrestrial telescope will act as a very strong magnifying glass or a weak microscope. This idea has been utilised in some small telescopes, so that they can be more conveniently used as "microscopes." It is unnecessary to mention pin-hole lenses or double pin-hole lenses for the myopic; they are well known.

It will be admitted that if the need for proper glasses is urgent they should be provided. The modern prismatic glasses have, of course, superseded the old binoculars in many ways.

I am, Sir, yours faithfully,

April 26th, 1917. MYOPE.

Σ.—The address of the National Council for Combating Venereal Diseases is now Bank Buildings, Kingsway, London, W.C. 2. Secretary, Miss H. F. Norry. Telephone: Holborn 562.

Entente.—The attitude to be adopted is entirely in the discretion of the practitioner. Where the medical man cannot from circumstances give reciprocal service it is usual for him to offer a fee, and quite reasonable that it should be accepted. Where the medical patient is more well-to-do than the adviser we have the same position. Operations stand in a different category, and when not performed for a colleague gratuitously, as they frequently are, they are usually made the subject of agreement. The question of the family is settled by similar considerations. There is no rule, but a very wide custom. This, however, would not invalidate legal proceedings.

Medical Diary for the ensuing Week.

SOCIETIES.

ROYAL SOCIETY OF MEDICINE, 1, Wimpole-street, W.

MEETINGS OF SECTIONS.

Wednesday, May 9th.

SURGERY: SUB-SECTION OF PROCTOLOGY (Hon. Secretaries—P. Lockhart-Mummery, W. Sampson Handley): at 5.30 P.M. Annual General Meeting.—Election of Officers and Council for 1917-1918.

Cases (at 5 P.M.):

Mr. P. Lockhart-Mummery: (1) Abdomino-perineal Excision of Rectum in a Man aged 28; (2) Ileo-sigmoidostomy for Colitis Polypo sa.

Discussion.

On "The Methods of Making and Closing Colostomy Openings," will be opened by Mr. Lockhart-Mummery.

Members of the SECTION OF SURGERY are specially invited to attend. Any who wish to take part in the Discussion are asked to send in their names to the Hon Secretary of the Sub-section.

Friday, May 11th.

CLINICAL (Hon. Secretaries—David Forsyth, T. P. Legg): at 8 P.M. Annual General Meeting.—Election of Officers and Council for 1917-1918.

Cases:

Dr. Parkes Weber: Intermittent Claudication of the Left Lower Extremity.

Dr. Irwin Moore: (1) Lupoid Tuberculosis of the Pharynx affecting the Uvula and Soft Palate in a Boy aged 8; (2) Two Cases of Pharyngeal Pouches.

Paper:

Dr. Parkes Weber: The Pel-Ebstein Recurrent Pyrexial Type of Hodgkin's Disease (Lymphogranulomatosis Maligna).

LECTURES, ADDRESSES, DEMONSTRATIONS, &c.

POST-GRADUATE COLLEGE, West London Hospital, Hammersmith-road, W.

MONDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Gray: Operations. Mr. B. Harman: Diseases of the Eye. Dr. Simson: Diseases of Women.

TUESDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.

WEDNESDAY.—10 A.M., Dr. Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.

THURSDAY.—Hospital closed. Annual Meeting.

FRIDAY.—10 A.M., Dr. Simson: Gynæcological Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.

SATURDAY.—10 A.M., Dr. Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. Mr. B. Harman: Eye Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.

THE THROAT HOSPITAL, Golden-square, W.

MONDAY.—5.15 P.M., Special Demonstration of Selected Cases.

THURSDAY.—5.15 P.M., Clinical Lecture.

ROYAL INSTITUTION OF GREAT BRITAIN, Albemarle-street, Piccadilly, W.

TUESDAY.—3 P.M., Prof. C. S. Sherrington: Rhythmic Action in Muscle and in Nerve. (Lecture II.)

ROYAL INSTITUTE OF PUBLIC HEALTH, Lecture Hall of the Institute, 37, Russell-square, W.C. 1.

Course of Lectures and Discussions on Public Health Problems under War and After-war Conditions:—

WEDNESDAY.—4 P.M., Lecture IV.:—Major F. W. Mott, M.D.: The Pathology of Venereal Disease. Followed by a discussion.

EDITORIAL NOTICES.

IT is most important that communications relating to the Editorial business of THE LANCET should be addressed *exclusively* "TO THE EDITOR," and not in any case to any gentleman who may be supposed to be connected with the Editorial staff. It is urgently necessary that attention should be given to this notice.

It is especially requested that early intelligence of local events having a medical interest, or which it is desirable to bring under the notice of the profession, may be sent direct to this office.

Lectures, original articles, and reports should be written on one side of the paper only, *and when accompanied by blocks it is requested that the name of the author, and if possible of the article, should be written on the blocks to facilitate identification.*

Letters, whether intended for insertion or for private information, must be authenticated by the names and addresses of their writers—not necessarily for publication.

We cannot prescribe or recommend practitioners.

We cannot undertake to return MSS. not used.

Offices: 423, STRAND, LONDON, W.C. 2.

MANAGER'S NOTICES.

ALTERATION IN THE PRICE OF "THE LANCET."

INCREASED war expenses and cost of production necessitate an increase of the price of THE LANCET. Commencing with the new year, the price was raised to 8*d*. The rates of subscription remain as revised in October.

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Subscriptions (which may commence at any time) are payable in advance. Cheques and Post Office Orders (crossed "London County and Westminster Bank, Covent Garden Branch") should be made payable to the Manager, Mr. CHARLES GOOD, THE LANCET Offices, 423, Strand, London, W.C. 2.

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WILL Subscribers please note that only those subscriptions which are sent direct to the Proprietors of THE LANCET at their Offices, 423, Strand, London, W.C. 2, are dealt with by them? Subscriptions paid to London or to local newsagents (with none of whom have the Proprietors any connexion whatever) do not reach THE LANCET Offices, and consequently inquiries concerning missing copies, &c., should be sent to the Agent to whom the subscription is paid, and *not* to THE LANCET Offices.

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Special terms for Position Pages.

Advertisements (to ensure insertion the same week) should be delivered at the Office not later than Wednesday, accompanied by a remittance.

METEOROLOGICAL READINGS.

(*Taken daily at 8.30 a.m. by Steward's Instruments.*)

THE LANCET Office, May 2nd, 1917.

Date.	Rainfall.	Solar Radio in Vacuo.	Maximum Temp. Shade.	Min. Tem.	Wet Bulb.	Dry Bulb.	Remarks.
April 26	...	83	58	37	39	43	Cloudy
,, 27	...	97	61	43	47	52	Cloudy
,, 28	...	105	63	45	49	54	Fine
,, 29	...	110	63	50	48	56	Cloudy
,, 30	...	90	63	49	50	57	Cloudy
May 1	...	93	66	47	50	53	Fine
,, 2	...	100	70	48	51	54	Fine

Other information which we have been accustomed to give in these "Readings" is withheld for the period of the war.

BOOKS, ETC., RECEIVED.

BAILLIÈRE, TINDALL, AND COX. London.
Manual of Chemistry. By W. Simon, Ph.D., M.D., and Daniel Bose, Ph.D. Eleventh edition, revised. 18s. net.

BELL, G., AND SONS, Ltd., London.
The Passing of the Great Race; or, The Racial Basis of European History. By Madison Grant, Chairman, New York Zoological Society; Councillor, American Geographical Society. 8s. 6d. net.

CAMBRIDGE UNIVERSITY PRESS.
Growth and Form. By D'Arcy W. Thompson. 21s. net.

CHURCHILL, J. AND A., London.
Method of Enzyme Action. By James Beatty, M.A., M.D., D.P.H. With Introduction by Professor E. H. Starling, M.D., Sc.D., F.R.S. 5s. net.

MASSON ET CIE., Paris. (Collection Horizon.)
Les Fractures de la Mâchoire Inférieure. Par L. Imbert et Pierre Réal. Avec Préface du Médecin Inspecteur Général Février. 4 fr.
Blessures du Crâne et du Cerveau. Formes Cliniques et Traitement Médico-Chirurgical. Par C. Chatelin et T. De Martel. 4 fr.
Traitement et Restauration des Lésions des Nerfs. Par Mme. Athanassio-Benisty, Interne des Hôpitaux de Paris. Avec Préface du Pr. Pierre Marie, Membre de l'Académie de Médecine. 4 fr.
Les Fractures de l'Orbite par Projectiles de Guerre. Par Félix Lagrange. 4 fr.
Les Psychonévroses de Guerre. Par le Dr. G. Roussy, Professeur Agrégé à la Faculté de Paris, et J. Lhermitte, Ancien Chef de Laboratoire à la Faculté de Paris. 4 fr.

MILFORD, HUMPHREY, OXFORD UNIVERSITY PRESS, London, Edinburgh, Glasgow, New York, Toronto, Melbourne, and Bombay.
Who Can be Happy and Free in Russia? By N. Nekrassov. Translated by Juliet M. Soskice, with introduction by Dr. David Soskice. The World's Classics. 1s. 3d. net.

Communications, Letters, &c., have been received from—

A.—Prof. F. W. Andrewes, Lond.; Messrs. Arnold and Sons, Lond.; Anglo-French Drug Co., Lond.; Messrs. Allen and Hanburys, Lond.; Albion Motor Car Co., Glasgow; Messrs. R. Anderson and Co., Lond.

B.—Mr. H. Bentley, Nottingham; Messrs. T. B. Browne, Lond.; British Organotherapy Co., Lond; Messrs. C. Birchall, Liverpool; Mr. E. Bougault, Paris; Messrs. W. H. Bailey and Son, Lond.; Capt. H. W. Bailey, R.A.M.C.; Mr. C. W. Bedford, Lond.; Messrs. Bale, Sons, and Danielsson, Lond.; Bolton Infirmary and Dispensary, Sec. of; Messrs. Butterworth and Co., Lond.; Dr. J. E. Bullock, Northampton; Bolingbroke Hospital, Lond., Sec. of; Dr. G. Briscoe, Lond.; Mr. K. S. Bhat, Lond.

C.—Chadwick Trust, Lond; Messrs. J. and A. Churchill, Lond.; Mr. H. J. Corin, Lond.; Dr. H. P. Cholmeley, Forest Row; Criminal Law Amendment Committee, Lond., Sec. of; Cheadle Royal, Cheadle, Medical Supt. of; Messrs. Cowie and Co., Lond.; Surg. F. L. Cassidi, R.N.; Committee for the Investigation of Atmospheric Pollution, Lond., Hon. Sec. of; Cumberland County Council, Clerk to the; Commonwealth of Australia, Lond., Official Sec. of; C. H. G.; Sir C. Cameron, Bart., Englefield Green.

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E.—East Suffolk and Ipswich Hospital, Ipswich, Sec. of; Entente; Mr. H. Elliott, Lond.

F.—Mr. W. F. Freeman, Lond.; Lieut.-Col. Sir Joseph Fayrer, Bart.; Pte. W. W. G. Ferguson; Dr. A. H. Fardon; Messrs. J. Feeney and Co., Birmingham; Dr. W. M. Fletcher, Lond.; Foster, Brown, and Co., Montreal.

G.—Mr. H. J. Gauvain, Alton; Dr. R. R. Giddings, Nottingham; Dr. J. Gay, Lond.; Messrs. Goddard and Smith, Lond.; Messrs. A. H. Grantham and Co., Reading; Mr. W. F. Gwynne, Fort Myers, U.S.A.; Glasgow Corporation, City Chamberlain of; Glasgow City Fever Hospital, Acting Physician Supt. of; Mr. H. Ginn, Worcester.

H.—Miss M. I. Hounsfield, Exeter; Messrs. Hirschfeld Bros., Lond.; Dr. R. J. M. Horne, Edinburgh; Highlands and Islands (Medical Service) Board, Edinburgh, Sec. of; Dr. T. J. Horder, Lond.; Dr. A. C. Houston, Lond.; Mr. W. Hurst, Glasgow; Messrs. C. J. Hewlett and Son, Lond.; Messrs. A. Heywood and Son, Manchester; Haywood Hospital, Burslem, Clerk to the; Lieut.-Col. L. W. Harrison, R.A.M.C.; Mr. T. M. Henny, Treherbert; Mr. R. Hayes, Lond.; Mr. R. Hitchins, Lond.; Dr. Hivaller; Surg. A. M. Horsey, R.N.

I.—Ipswich Guardians, Clerk to the; Mrs. Ives, Southampton; Inspector of Lunatics for Ireland, Dublin.

J.—Dr. R. B. Jackson, Culkey; Mr. J. S. Jobson, Hill Redware; Dr. W. Jamison, Abercynon.

K.—Messrs. H. S. King and Co., Lond.; King Edward's Hospital Fund for London, Hon. Sec. of; Mr. H. A. King, Reading; Asst. Surg. W. V. Kane, Jubblepore; Prof. A. Keith, Lond.

L.—Leicester Royal Infirmary, House Governor of; Messrs. Lee and Martin, Handsworth; Local Government Board, Lond.; Dr. R. B. Low, Lond.; Messrs. H. K. Lewis and Co., Lond.; Mr. J. P. Lockhart-Mummery, Lond.; L. M. W.

M.—Mr. A. J. MacLeod, Hull; Capt. C. R. McIntosh, R.A.M.C.; Medical Society of London, Registrar of; Miss J. Milne, Lond.; Messrs Mawson and Swan, Newcastle-on-Tyne; Messrs. R. Morrison and Co., Lond.; Messrs. Mather and Crowther, Lond; Dr. H. L. McKisack, Belfast; Capt. J. M. Mitchell, R.A.M.C.; Mrs. Messenger, Sheffield; Messrs. C. Mitchell and Co., Lond.; Messrs. Macmillan and Co., Lond.; Mr. W. Martindale, Lond.; Manhu Food Co., Liverpool; Medico-Psychological Association of Great Britain and Ireland, Acting Hon. Gen. Sec. of; Mr. J. McClure, Lond.

N.—Dr. D. Newman, Glasgow; Mr. S. Neave, Ingatestone; Sir George Newman, Lond.; National Medical Union, Lond., Asst. Sec. of; Nottingham City Asylum, Mapperley Hall, Clerk to the; Newspaper Society, Lond., Sec. of; Major E. H. Nash, R.A.M.C.

O.—Oxford Medical Publications, Lond., Manager of; Capt. E. O'Connor, R.A.M.C.

P.—Mr. W. H. Plaister, Lond.; Capt. J. H. Peters, R.A.M.C.; Mr. V. G. Plarr, Lond.; Dr. M. S. Pembrey, Lond.

Q.—Queen Mary's Hospital for the East End, Stratford, Sec. of.

R.—Royal Academy of Medicine in Ireland, Dublin; Royal Institution of Great Britain, Lond.; Royal College of Surgeons of England; Rochester and Chatham Printing Co., Rochester; Rotherham Hospital, Sec. of; Messrs. Reuters, Lond.; Messrs. Richardson and Co., Lond.; Royal Society of Arts, Lond.; Royal Academy of Arts, Lond., Sec. of; Dr. R. Rundle, Southsea; Lance-Corpl. T. Reed; Rhondda Urban District Council, Pentre, Clerk to the; Royal Society of Medicine, Lond., Sec. of; Médecin-Major H. Roger; Mr. S. E. Ramseyer, New York; Royal Society, Lond.

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V.—Victoria Hospital for Sick Children, Hull, Sec. of; Dr. Volrath Vogt, Yi-Yang, China; Mr. L. Vecchio, Manchester; Mr. S. C. Varley, Lond.

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Y.—Y.M.C.A. Lecture Department, Shanghai, Sec. of; Dr. R. A. Young, Lond.

Letters, each with enclosure, are also acknowledged from—

A.—Aberdeen University, Sec. of; Messrs. T. and M. Armstrong, Lond.; Mr. E. Arnold, Lond.; Ashwood House, Kingswinford, Medical Supt. of; A. V. D.;

B.—Dr. T. L. Bunting, Scotswood-on-Tyne; Dr. D. Bower, Bedford; British Oxygen Co., Lond., Sec. of; Mr. H. Beattie, Banbury; Birmingham and Midland Ear and Throat Hospital, Sec. of; Messrs. Burt, Boulton, and Harwood, Lond.; Messrs. Butterfield and Son, Northampton; Capt. R. L. Barwick, R.A.M.C.; Lieut.-Col. C. R. Bakble, I.M.S.; *Bodmin Guardian and Express*, Manager of.

C.—Dr. A. Charpentier, Uxbridge; *Crewe Guardian*; C. W. D; Capt. J. G. Cooke, R.A.M.C.; Messrs. Carnrick and Co., Lond.; Cambridge Hospital, Aldershot, Librarian of; Mr. V. Chartsing, Nawabad; Dr. J. Crow, Largs; Mr. A. G. Chamberlain, Exeter; Dr. W. S. Clark, Degema.

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